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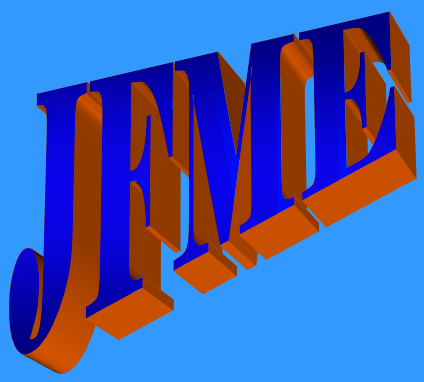

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"VICTOR SLĂVESCU" CENTRE FOR FINANCIAL AND MONETARY RESEARCH

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SECTION I. FISCAL ISSUES IN THE GLOBALIZED ECONOMY

IMPLICATIONS OF THE TRANSITION TO THE CIRCULAR ECONOMY ON ENERGY POVERTY AT EUROPEAN LEVEL

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Abstract:

The COVID-19 pandemic has brought into question the issue of housing space and decent living and working conditions. With the outbreak of the war in Ukraine, the problem has worsened due to the ever-increasing costs of energy products (especially oil and gas) at the European level. For the most vulnerable citizens, seriously exposed to the risk of energy poverty, solutions vary in the scope of restricting consumption, using dangerous non-compliant materials for heating and cooking, postponing bill payments, but also reducing spending on essential goods, such as food and medicine. Against this background, the increasingly important climate ambitions of European Union officials regarding the reduction of greenhouse gas emissions and the transition to a circular economy worsen the situation, through necessary investments in key infrastructure (e.g. energy, transport, etc.), which lead, through successive implications, to the support of these costs at the citizen level. In this context, the article analyzes, through an econometric model, with panel data, for the period 2015-2024, the implications of the circular economy transition captured by circular economy indicators on some energy poverty indicators at the EU27 level.

Keywords: *energy poverty, circular economy, correlations, feedback*

JEL classification: *C23, I31, P46*

Introduction

The multifaceted nature of poverty can make addressing specific types of poverty - such as energy poverty - extremely interesting. Addressing energy poverty is vital for economic development, having close links with income poverty, but also with structural problems in areas such as construction and energy. Energy poverty, especially for the most vulnerable categories

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of the population, can be viewed from a climate perspective as an enhancer of climate problems, by exposing the vulnerable population to the use of more polluted and more dangerous heating sources and resources for human health and the environment. Thus, not only the reduction of costs and the clear benefits for humans such as combating diseases (respiratory, mental, cardiac, etc.), improving educational performance and general well-being, but also the protection and conservation of the environment.

At the same time, the increased need to accelerate climate reform in all areas of economic and social life may put increased pressure on combating energy poverty issues, especially if the vulnerable groups affected by the two types of phenomena (energy poverty and economic reforms to comply with the EU27 climate commitments) are not identified or they are not identified correctly and clearly enough or they are not protected by effective measures. For this reason, the link between the circular economy and energy poverty deserves increased interest in investigation.

Thus, this article explores the implications of some circular economy indicators on energy poverty indicators on at the European Union (EU27) level. The article uses a panel econometric model to analyze the impact of circular economy on variables such as Arrears on utility bills, At risk of poverty or social exclusion, Energy import dependency, Electricity prices for household consumers, Final consumption expenditure of households, Share of renewable energy in gross final energy consumption for the period 2015-2024. The data sources are extremely different, mainly based on Energy Poverty Advisory Hub (EPAH), Eurostat, and European Commission documents. Although the circular economy is an important climate and environmental objective, it should not be seen as an end in itself and as a target on a limited time horizon, but as an integrative way of perceiving reality with serious implications in all aspects of life, including the issue of energy poverty. That is why it is important to see not only the short-term advantages or disadvantages, but as a way in which problems combine, become complicated, but can also express the potential for mutual problem-solving. Only in this way can circularity propose valid, medium- and long-term solutions to energy poverty.

Literature Review

The issue of energy poverty has received increasing attention in the academic literature over the past two decades, being closely linked to economic inequalities, unequal access to resources, and shifts in energy policies at both national and European levels. According to recent studies, energy poverty is defined not only by the lack of physical access to energy sources but also by households' inability to meet their basic energy needs in a safe, healthy, and affordable manner (Bouzarovski & Petrova, 2015; Boardman, 2010).
Following the outbreak of the COVID-19 pandemic, numerous studies have highlighted a worsening of these problems, particularly among vulnerable groups, due to social isolation, reduced income, and increased household energy consumption (Sovacool et al., 2020; Middlemiss & Gillard, 2021). In parallel, the literature has underlined the indirect impact of climate policies on these groups, in the context of the green transition and the rising costs associated with its implementation (Jenkins et al., 2021). At the same time, the concept of the circular economy has become central to debates on sustainable development, being promoted as an alternative to the traditional linear economic model. Specialist studies indicate that a well-implemented circular economy can help reduce pressure on natural resources, diminish waste,

and create new job opportunities (Kirchherr et al., 2017; Geissdoerfer et al., 2017). However, few studies have directly examined how this transition affects energy poverty or the living conditions of the most vulnerable citizens.
Several authors have warned of the risk that transition policies may generate additional inequalities if not accompanied by compensatory measures and adequate social protection mechanisms (Simcock & Walker, 2020). It is also noted that the investments required for green infrastructure—such as in transport or energy efficiency—may lead, at least in the short term, to increased costs borne indirectly by the population (Sorrell, 2015).
As for the empirical analysis of the relationship between the circular economy and energy poverty, the literature is still in an emerging phase. Some recent research attempts to establish links between circularity indicators and population well-being, but the results are often contextual and difficult to generalize (Ritzen & Sandström, 2017). In particular, comparative data at the EU member state level are rarely analyzed using panel econometric models, leaving room for further scientific contributions exploring this research direction.

Methodology and Data

In terms of methodology, the analysis refers to the relationship between a series of circular economy indicators and some energy poverty indicators. The study period is 2015 - 2024, and the method is estimation by the ordinary least squares method. Where the data stop in the previous period, for example 2022 or 2023, they are extended by extrapolation, and where they are missing from the series, there has been used interpolation methods. Thus, the results should be viewed with reservations.

Below there are the variables selected for analysis; so the first six represent indicators of the energy poverty and the last four represent indicators of circular economy.

Table 1: The indicators used and their description

Variables name	Acronym	Unit of measure	Data source
Arrears on utility bills - No disaggregation	UBA	% of households	EPAH
At risk of poverty or social exclusion - Total	RPSE	% of population	EPAH
Energy import dependency by products	EID	%	Eurostat [sdg_07_50]
Electricity prices for household consumers - bi-annual data (from 2007 onwards), second semester	EPH	Euro/kWh	Eurostat [nrg_pc_204]
Final consumption expenditure of households - Total	FCE	k€/capita	EPAH
Share of renewable energy in gross final energy consumption by sector	SRE	%	Eurostat [sdg_07_40]
Consumption footprint - single weighted score	CFP	Planetary Boundary	Eurostat, [sdg_12_31]
Circular material use rate	CMUR	Percentage	Eurostat, [sdg_12_41]
Gross value added in environmental goods and services sector	GVAEG	Percentage of GDP	Eurostat, [sdg_12_61__custom_17563732]
Consumption of Raw material	CRM	Tonnes per capita	Eurostat, [sdg_12_21]

Source: EPAH and Eurostat, authors' selection.

The geographical area of analysis is the European Union with 27 countries. The final number of observations obtained is 270, the volume of data can be considered relatively small. Although there are studies that place the share of renewable energy in gross final energy consumption within the framework of circularity indicators, we use it in this study as an indicator of energy poverty. This is due to the fact that the energy sector is a central factor in the evolution of energy poverty.
The option for the regression model is justified by the fact that the panel data econometric model combines multiple observations for the same entities (e.g. countries) over multiple time periods compared to other econometric models.

Results

In order to identify the link between the evolution of the independent indicators and the dependent variable, a series of specific indicators of EPAH, and Eurostat were selected. The descriptive statistics are presented in Table 2. Thus, the mean, median, standard deviation, Skewness and Kurtosis were highlighted. The standard deviation is kept relatively close to the mean and below it, which means low variability, a high degree of consistency and relatively low dispersion within the data set. The mean and median are generally close to each other suggesting a relatively symmetrical distribution, which may suggest that the data may be normally distributed.
The data shows a Skewness with values generally lower than two, except for the UBA indicator, which can be considered acceptable for evaluating the normality of the data series. Regarding Skewness, most indicators are positive, so it is possible that outliers are positioned at the top of the data set, pulling the mean to the right in relation to the median. Only the EID indicator has a negative Skewness, which indicates a frequency distribution that presents an asymmetric tail in the area of values lower than the mean, pulling the mean to the left in relation to the median.

Table 2: The Statistics description of the selected variables

	UBA	RPSE	EID	EPH	FCE	SRE	CFP	CMUR	GVAEG	CRM
Mean	8.6908	21.4941	57.6365	0.1489	15.4898	23.6218	3.3757	9.4009	2.5697	19.1749
Median	6.5000	20.0500	58.9800	0.1260	14.5928	19.7913	3.3800	8.0500	2.3200	16.5365
Maximum	42.2000	46.0000	103.0520	0.4590	39.8500	68.3260	4.8500	31.7667	6.3850	49.3110
Minimum	1.2000	10.7000	1.2290	0.0771	4.2900	4.9870	2.0700	1.2333	0.4700	8.8570
Std. Dev.	7.5787	6.1056	22.8537	0.0650	6.7844	12.3430	0.6226	6.5433	1.2310	7.8922
Skewness	2.1891	1.2524	-0.2228	1.9086	0.7679	1.1293	0.0016	1.0880	0.8535	1.4638
Kurtosis	8.0314	5.0758	2.5603	7.4733	3.7423	4.2141	2.4390	3.7034	3.6722	5.2277
Jarque-Bera	500.4363	119.0651	4.4090	389.0448	32.7327	73.9723	3.5402	58.8342	37.8634	152.2582
Probability	0.0000	0.0000	0.0110	0.0000	0.0000	0.0000	0.0170	0.0000	0.0000	0.0000
Sum	2.346.522	5.803.41	15561.87	40.2115	4.182.257	6.377.880	911.4267	2.538.233	693.8275	5.177.223
Sum Sq. Dev.	15450.32	10028.02	140496.5	1.137281	12381.62	40982.03	104.2676	11517.17	407.6182	16755.18
Observations	270	270	270	270	270	270	270	270	270	270

Source: EPAH and Eurostat, authors' calculation in EViews9.

Regarding Kurtosis, positive values indicate a distribution with a “peak” higher than the normal distribution, thus for most of the studied variables the Kurtosis is substantially above 3 (except EID and CFP, with values below 3, and FCE, CMUR and GVAEG, with values above, but closet to 3), indicating that the distribution is leptokurtic, producing more values than a normal distribution.

To better elucidate the consistency of the normal distribution of the data set, additional tests are developed such as a unit root test - ADF (Augmented Dickey-Fuller).

In Table 3, in order to reduce the number of ADF tests from 10 to 1, the clustered unit root summarization test was used. Using a common unit root method, the study observed that all the statistical methods mentioned in Table 3 regarding Levin, Lin & Chu T*, IM, Pesaran and Shin W-Stat, ADF-FISHER Chi-Square and PP-Fisher Chi-Square have significant statistics and probabilities. For example, ADF - Fisher Chi-Square has a statistical value of 159.206 and a probability of 0.0000. In other words, the selected indicators are presented as a stationary series, that all the variables used in this investigation are stationary at order 0.

Table 3: Augmented Dickey-Fuller unit root test for the selected variables

Group unit root test: Summary				
Series: UBA, RPSE, EID, EPH, FCE, SRE, CFP, CMUR, GVAEG, CRM				
Date: 09/19/25, Sample: 1 270, Exogenous variables: Individual effects, individual linear trends				
Automatic selection of maximum lags, Automatic lag length selection based on SIC: 0				
Newey-West automatic bandwidth selection and Bartlett kernel, Balanced observations for each test				
Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.06058	0.0000	10	2690
Breitung t-stat	-11.3656	0.0000	10	2680
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-10.7854	0.0000	10	2690
ADF - Fisher Chi-square	159.206	0.0000	10	2690
PP - Fisher Chi-square	162.068	0.0000	10	2690
** Probabilities for Fisher tests are computed using an asymptotic Chi				
-square distribution. All other tests assume asymptotic normality.				

Source: EPAH and Eurostat, authors' calculation in EViews9.

Table 4 shows the correlation matrix between the independent variables and the dependent variables. The dependent variables are UBA, RPSE, EID, EPH, FCE, SRE. Thus, it can be observed that the most values are below 0.70, which suggests a low risk of collinearity. But in order to have a more accurate picture, in the appendix, the tolerance or variance inflation factor (VIF) is also analyzed, which clearly shows, with great reliability, that there is no collinearity problem for the variables selected (see Annex).

From the correlation matrix it is observed that the links between the dependent and independent variables are either positive or negative. For example, for the dependent variables UBA and RPSE the correlations for the selected independent variables are negative while for FCE, EPH it is predominantly positive while for others EID and SRE it is mixed.

Interpretation is difficult, in the sense that many energy poverty indicators have negative

significance (except the share of renewable energy - SRE), while circularity indicators have mixed significance, generally going in the direction of improvement, so the inverse correlation between the two types of indicators should theoretically be interpreted positively. However, there is a bidirectionality and interconditioning that is difficult to detect based on the correlation matrix alone.

Table 4: Correlation matrix of the variables

	UBA	*RPSE*	*EID*	*EPH*	*FCE*	*SRE*	*CFP*	*CMUR*	*GVAEG*	*CRM*
UBA	1									
RPSE	0.6280	1								
EID	0.0126	-0.0794	1							
EPH	-0.1578	-0.1464	0.2556	1						
FCE	-0.4359	-0.4055	0.3328	0.4761	1					
SRE	-0.0957	-0.0208	-0.5368	0.0091	0.0784	1				
CFP	-0.4611	-0.4122	0.3444	0.3913	0.8324	-0.0048	1			
CMUR	-0.4479	-0.3285	0.0617	0.2071	0.3128	-0.2228	0.2873	1		
GVAEG	-0.2131	-0.0669	-0.4388	0.1230	0.2889	0.6763	0.1707	0.0852	1	
CRM	-0.2267	-0.1610	-0.3422	-0.0585	0.3444	0.3756	0.2905	-0.0089	0.6671	1

Source: EPAH and Eurostat, authors' calculation in EViews9.

Based on the correlation matrix, the regression equations constructed are as follows:

$$UBA = f(CFP, CMUR, GVAEG, CRM) \quad (1)$$

$$RPSE = f(CFP, CMUR, GVAEG, CRM) \quad (2)$$

$$EID = f(CFP, CMUR, GVAEG, CRM) \quad (3)$$

$$EPH = f(CFP, CMUR, GVAEG, CRM) \quad (4)$$

$$FCE = f(CFP, CMUR, GVAEG, CRM) \quad (5)$$

$$SRE = f(CFP, CMUR, GVAEG, CRM) \quad (6)$$

The equations are represented by the form:

$$Y=\alpha+\beta_1x_1+\beta_2x_2+\beta_3x_3+\beta_4x_4+\varepsilon$$

Where: Y = the dependent variable, chosen successively: Arrears on utility bills - No disaggregation – UBA, At risk of poverty or social exclusion – Total – RPSE, Energy import dependency by products – EID, Electricity prices for household consumers - bi-annual data (from 2007 onwards), second semester – EPH, Final consumption expenditure of households – Total – FCE, Share of renewable energy in gross final energy consumption by sector – SRE.

α= Constant; β_{1-4} = slope of variables x_1–x_4 – coefficients; x_1–x_4 = regression coefficients or independent variables, more precisely: Consumption footprint - single weighted score – CFP, Circular material use rate – CMUR, Gross value added in environmental goods and services sector – GVAEG, Consumption of Raw

material – CRM; ε = error term.

Thus, it can be observed (see Table 5) that for UBA, RPSE and EID, R-squared and adjusted R-squared are not considerable, with values below 0.50, they can still be considered relevant. The probability (F statistic) is adequate for all equations, being well below 0.05. And for all equations the coefficients are generally negative, except for equation 3 in table 5, in which the coefficient of CFP is considerable and positive. Also, according to the probabilities, from the first equation the variables GVAEG and CRM should be eliminated, from the second equation, GVAEG and CRM and from the third equation CMUR.

Table 5: Regression equation results for UBA, RPSE and EID in relation with climate change variables

Method: Least Squares, Included observations: 270				**Coefficient**	**t-Statistic**	**Probability**
Dependent Variable	UBA	Independent Variables	C	28.50255	13.36325	0.0000
R-squared	0.340627		CFP	-3.92606	-5.88024	0.0000
Adjusted R-squared	0.330674		CMUR	-0.40567	-6.62667	0.0000
F-statistic	34.22418		GVAEG	-0.41549	-0.99766	0.3194
Prob(F-statistic)	0.000000		CRM	-0.08748	-1.30210	0.1940
Method: Least Squares, Included observations: 270				**Coefficient**	**t-Statistic**	**Probability**
Dependent Variable	RPSE	Independent Variables	C	34.964150	18.801900	0.0000
R-squared	0.227759		CFP	-3.123185	-5.365208	0.0000
Adjusted R-squared	0.216102		CMUR	-0.230225	-4.313460	0.0000
F-statistic	19.53928		GVAEG	0.497023	1.368834	0.1722
Prob(F-statistic)	0.000000		CRM	-0.106397	-1.816477	0.0704
Method: Least Squares, Included observations: 270				**Coefficient**	**t-Statistic**	**Probability**
Dependent Variable	EID	Independent Variables	C	29.040270	4.758163	0.0000
R-squared	0.406278		CFP	18.074580	9.460560	0.0000
Adjusted R-squared	0.397316		CMUR	-0.182211	-1.040177	0.2992
F-statistic	45.33421		GVAEG	-6.501804	-5.455923	0.0000
Prob(F-statistic)	0.000000		CRM	-0.729935	-3.797048	0.0002

Source: EPAH and Eurostat, authors' calculation in EViews9. Variables that should be accepted according to the adequacy of the probability (below 0.05) are marked in gray.

In Table 6 it can be seen that for SRE and FCE, R-squared and adjusted R-squared are considerable, with values above 0.50, and can be considered highly relevant.

The probability (F statistic) is adequate for all equations, being well below 0.05. For the first two equations the coefficients are generally positive, except for equation 3 in table 6, where the coefficients are generally negative, except for the coefficient of GVAEG which is considerable and positive.

This is perfectly explainable, a higher gross value added from environmental goods implies that alignment with European standards stimulates the increase in the share of renewable energy. Also, according to the adequacy of the probabilities, the CMUR variable should be eliminated from the first equation in table 6, CRM from the second equation and CFP from the third equation.

Table 6: Regression equation results for EPH, FCE and SRE in relation with climate change variables

Method: Least Squares, Included observations: 270				**Coefficient**	**t-Statistic**	**Probability**
Dependent Variable	EPH	Independent Variables	C	0.010068	0.512957	0.6084
R-squared	0.241491		CFP	0.045633	7.427298	0.0000
Adjusted R-squared	0.230042		CMUR	0.000521	0.924662	0.3560
F-statistic	21.09238		GVAEG	0.015925	4.155517	0.0000
Prob(F-statistic)	0.000000		CRM	-0.003181	-5.145560	0.0000
Method: Least Squares, Included observations: 270				**Coefficient**	**t-Statistic**	**Probability**
Dependent Variable	FCE	Independent Variables	C	-16.26188	-13.08823	0.0000
R-squared	0.720792		CFP	8.478525	21.79920	0.0000
Adjusted R-squared	0.716577		CMUR	0.081763	2.292761	0.0226
F-statistic	171.0282		GVAEG	0.694467	2.862578	0.0045
Prob(F-statistic)	0.000000		CRM	0.030139	0.770129	0.4419
Method: Least Squares, Included observations: 270				**Coefficient**	**t-Statistic**	**Probability**
Dependent Variable	SRE	Independent Variables	C	13.58451	4.748297	0.0000
R-squared	0.552756		CFP	-0.236777	-0.264388	0.7917
Adjusted R-squared	0.546005		CMUR	-0.547465	-6.667197	0.0000
F-statistic	8.316607		GVAEG	8.163281	14.613500	0.0000
Prob(F-statistic)	0.000000		CRM	-0.260458	-2.890380	0.0042

Source: EPAH and Eurostat, authors' calculation in EViews9. Variables that should be accepted according to the adequacy of the probability (below 0.05) are marked in gray.

At the same time, if we also apply a Granger causality (Table 7), and select only the relationships that have a probability value below 0.05 or in its proximity, we observe an important element in the modeling of the relationship, namely that the electricity price is influenced and dramatically influences the final consumption of households.

At the same time, if we refer to the influence of the dependent variables on the independent one, we also observe a bidirectionality between variables, especially between Consumption footprint (CFP) and Electricity prices for household consumers (EPH). This once again says that there is much to be done in the energy field in order to break the electricity price (especially by decreasing it) from the Consumption footprint.

Table 7: Variables Granger Causality Test Results

Pairwise Granger Causality Tests, Date: 09/19/25, Sample: 1 270, Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
EPH does not Granger Cause UBA	268	2.89274	0.0572
EPH does not Granger Cause RPSE	268	5.20453	0.0061
FCE does not Granger Cause EPH	268	4.15308	0.0168
EPH does not Granger Cause FCE	268	5.17892	0.0062
CFP does not Granger Cause EPH	268	2.46525	0.0869
EPH does not Granger Cause CFP	268	2.49793	0.0842
EPH does not Granger Cause CRM	268	2.39881	0.0928

Source: EPAH and Eurostat, authors' calculation in EViews9. Variables that should be accepted according to the adequacy of the probability (below 0.05) are marked in gray.

Conclusions

Energy poverty is one of the many forms of poverty that affect the daily lives of citizens, but also of the private environment and institutions. Although it is mainly observed at the population level, it describes numerous shortcomings of the general social and economic sphere.

At the same time, although it influences environmental parameters and especially the population's relationship to nature, energy poverty is also influenced by the transition to a green economy and a circular economy.

Ideally, the transition to a circular economy should be borne mainly by companies and public institutions, but in reality the transition is often reflected through prices at the population level, worsening energy poverty. Thus, this article highlights how circularity influences energy poverty and the results indicate the need for a greater effort to break economic growth and well-being from resource consumption, including through fairer control over energy prices.

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Annex

Table 8: Additional tests and robustness checks for UBA

Fact-finding checks			F - Statistics	P-value
Ramsey RESET -Stability test			49.05139	0.0000
Heteroskedasticity Test: Breusch-Pagan-Godfrey			10.40527	0.0000
LM test			325.8203	0.0000
Multi-Collinearity test for initial equation	**Coefficient variance**	**Centered VIF**	**Result analysis**	**Observations**
C	4.549286	NA	VIF<10	No interconnectivity of independent variables
CFP	0.445783	1.209064	VIF<10	No interconnectivity of independent variables
CMUR	0.003748	1.122739	VIF<10	No interconnectivity of independent variables
GVAEG	0.173441	1.839002	VIF<10	No interconnectivity of independent variables
CRM	0.004513	1.967084	VIF<10	No interconnectivity of independent variables

CUSUM test

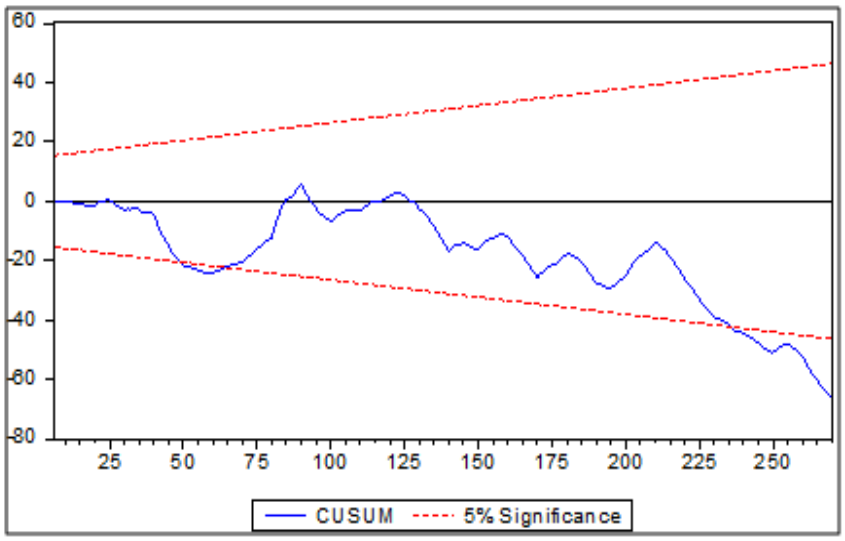


Table 9: Additional tests and robustness checks for RPSE

Fact-finding checks			F - Statistics	P-value
Ramsey RESET -Stability test			94.75471	0.0000
Heteroskedasticity Test: Breusch-Pagan-Godfrey			28.17543	0.0000
LM test			427.6292	0.0000
Multi-Collinearity test for initial equation	**Coefficient variance**	**Centered VIF**	**Result analysis**	**Observations**
C	3.458138	NA	VIF<10	No interconnectivity of independent variables
CFP	0.338862	1.209064	VIF<10	No interconnectivity of independent variables
CMUR	0.002849	1.122739	VIF<10	No interconnectivity of independent variables
GVAEG	0.131841	1.839002	VIF<10	No interconnectivity of independent variables
CRM	0.003431	1.967084	VIF<10	No interconnectivity of independent variables

CUSUM test

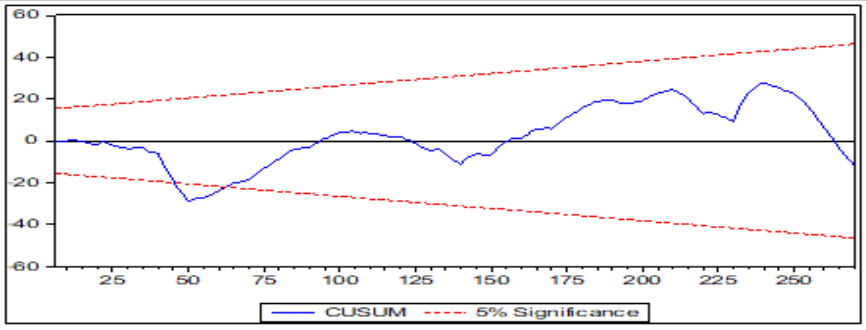


Table 10: Additional tests and robustness checks for EID

Fact-finding checks			F - Statistics	P-value
Ramsey RESET -Stability test			0.242279	0.6230
Heteroskedasticity Test: Breusch-Pagan-Godfrey			17.8176	0.0000
LM test			347.5038	0.0000
Multi-Collinearity test for initial equation	Coefficient variance	Centered VIF	Result analysis	Observations
C	37.24970	NA	VIF<10	No interconnectivity of independent variables
CFP	3.65008	1.209064	VIF<10	No interconnectivity of independent variables
CMUR	0.03069	1.122739	VIF<10	No interconnectivity of independent variables
GVAEG	1.42014	1.839002	VIF<10	No interconnectivity of independent variables
CRM	0.03696	1.967084	VIF<10	No interconnectivity of independent variables

CUSUM test

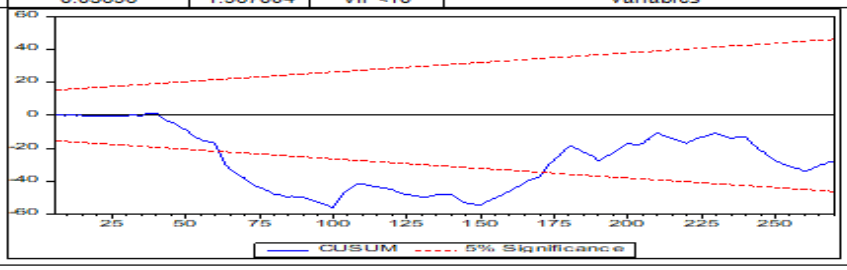


Table 11: Additional tests and robustness checks for EPH

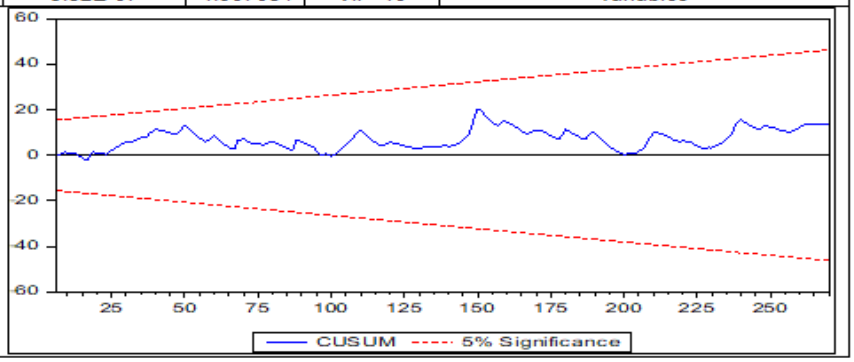
Fact-finding checks			F - Statistics	P-value
Ramsey RESET -Stability test			10.72494	0.0012
Heteroskedasticity Test: Breusch-Pagan-Godfrey			2.576689	0.0380
LM test			65.9956	0.0000
Multi-Collinearity test for initial equation	**Coefficient variance**	**Centered VIF**	**Result analysis**	**Observations**
C	0.000385	NA	VIF<10	No interconnectivity of independent variables
CFP	3.77E-05	1.209064	VIF<10	No interconnectivity of independent variables
CMUR	3.17E-07	1.122739	VIF<10	No interconnectivity of independent variables
GVAEG	1.47E-05	1.839002	VIF<10	No interconnectivity of independent variables
CRM	3.82E-07	1.967084	VIF<10	No interconnectivity of independent variables
CUSUM test				

Table 12: Additional tests and robustness checks for FCE

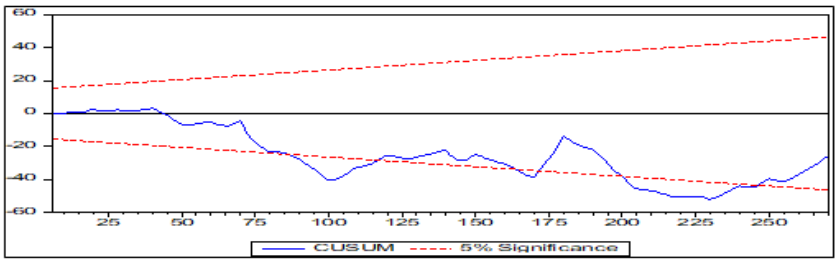
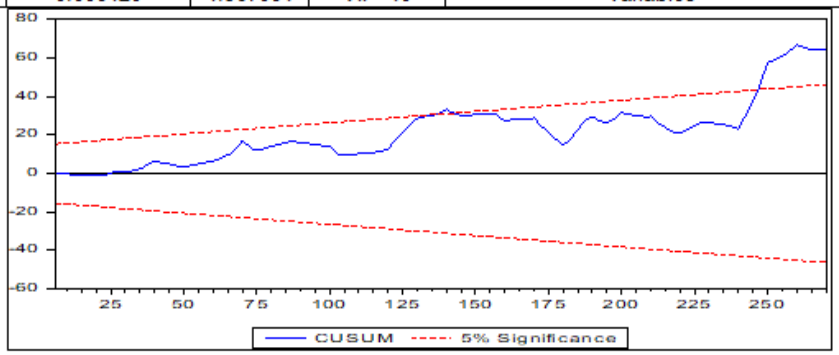
Fact-finding checks			F - Statistics	P-value
Ramsey RESET -Stability test			40.596	0.0000
Heteroskedasticity Test: Breusch-Pagan-Godfrey			13.23708	0.0000
LM test			346.8124	0.0000
Multi-Collinearity test for initial equation	**Coefficient variance**	**Centered VIF**	**Result analysis**	**Observations**
C	1.54376	NA	VIF<10	No interconnectivity of independent variables
CFP	0.151272	1.209064	VIF<10	No interconnectivity of independent variables
CMUR	0.001272	1.122739	VIF<10	No interconnectivity of independent variables
GVAEG	0.058856	1.839002	VIF<10	No interconnectivity of independent variables
CRM	0.001532	1.967084	VIF<10	No interconnectivity of independent variables
CUSUM test				

Table 13: Additional tests and robustness checks for SRE

Fact-finding checks			F - Statistics	P-value
Ramsey RESET -Stability test			0.116104	0.7336
Heteroskedasticity Test: Breusch-Pagan-Godfrey			4.255929	0.0024
LM test			307.7315	0.0000
Multi-Collinearity test for initial equation	**Coefficient variance**	**Centered VIF**	**Result analysis**	**Observations**
C	8.184884	NA	VIF<10	No interconnectivity of independent variables
CFP	0.802033	1.209064	VIF<10	No interconnectivity of independent variables
CMUR	0.006743	1.122739	VIF<10	No interconnectivity of independent variables
GVAEG	0.312048	1.839002	VIF<10	No interconnectivity of independent variables
CRM	0.008120	1.967084	VIF<10	No interconnectivity of independent variables
CUSUM test				

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WAYS FOR IMPROVING THE SPECIFIC TAXATION SYSTEM APPLIED TO THE OIL AND NATURAL GAS SECTOR IN ROMANIA

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Abstract:

As a sequel of research from previous years, this article aims to improve the specific taxation system applied to the oil and gas sector in Romania. The first part of the paper characterizes the specific taxation system applied to this sector, from which it results that the current upstream sector taxation system is, eminently, one oriented towards achieving short-term budgetary revenues, which does not bring a balance between the needs of the present and those of the future, being, thus, unsustainable in the long term. For these reasons, the second part of the article is dedicated to outlining measures to improve the current taxation system in the oil industry in our country. Given the identified deficiencies, and in order to achieve a balance between the needs of the present and those of the future, on the one hand, and the budgetary needs of the state and other strategic objectives, as well as the needs of the state and those of investors, on the other hand, the article has identified and detailed a set of measures that could have potential beneficial effects. But these must be balanced in a way that ensures energy security, protects vulnerable consumers, does not discourage investments, and at the same time allows the proper functioning of the energy market. And adapting a flexible hydrocarbon taxation system to exogenous stressors in order to ensure the need for crude oil and natural gas in crisis conditions is the solution to this problem.

Keywords: *oil and gas industry, tax regime, taxation system, royalties*

JEL classification: *G18, H25, L71, E62, F64*

Introduction: Why this approach

Petroleum activities around the world are subject to a wide range of taxation instruments. These include taxes that apply to all other sectors of the economy and taxes specific to the oil and gas industry (EY, 2022). In addition, forms of tax revenue from rent (such as surface fees, bonuses

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and production sharing) are commonly used in the taxation of upstream activities (Deloitte, 2018c; PwC, 2019).

Petroleum tax regimes often include special provisions to modify the timing or amount of revenue allocations. These provisions are typically designed as incentives to attract investors or to address the unique attributes of an oil asset or to influence investors' choices within the scope of specific public policy objectives (Van Meurs et al., 2021).

Therefore, both in Romania and in other European countries, we encounter different types of royalties, taxes, fees or additional contributions applied to the oil and natural gas industry in conjunction with the general taxation rules specific to each state.

As such, the tax environment applicable to companies in Romania operating in the oil and gas industry consists of: the general taxation system (such as: profit tax; income tax; VAT; excise duties; local taxes and fees), and the sector-specific taxation system (such as: oil royalties due for the production of crude oil and natural gas; taxes on additional income from the sale of onshore, offshore and deep onshore natural gas; additional tax applicable to crude oil production; contributions due for the production of electricity in power plants owned by oil agreement holders; contributions due by oil agreement holders for the activity of trading natural gas and electricity; other specific contributions related to the sector).

Under these conditions, establishing an adequate oil and gas sector taxation regime for Romania must start from analyzing the specific conditions of this sector in our country.

Literature review: the general context of the specific tax regimein the oil and gas sector in Romania

The accelerated increase in natural gas and electricity prices starting in the second half of 2021, with a significant impact on inflation, led to a series of intervention and consumer support measures among the European Union member states (Deloitte, 2018b).

At the Romanian level, the intervention measures began with Emergency Ordinance (OUG) no. 118/2021 on the establishment of a compensation scheme for electricity and natural gas consumption for the cold season 2021 - 2022, its approval law, OUG no. 27/2022, OUG no. 106/2022 and last but not least OUG no. 119/2022. On the other hand, Romania has already implemented a specific taxation system for the oil and gas sector for many years (e.g. additional taxes, oil royalties), which makes profits from this sector subject to an effective tax rate higher than the corporate tax rate of 16% (Mitrita and Nita, 2021).

Electricity prices have begun to rise based on a combination of factors, the most important of which is the high price of natural gas which is used in the electricity production process (CEC, 2022).

Natural gas-fired power plants are needed to meet electricity demand when demand is highest during the day or when the volumes of electricity produced from other technologies, such as nuclear power, hydroelectric power or energy from renewable sources, are not sufficient to cover demand (GDZ, 2021).

Moreover, Russia's military aggression against Ukraine, a contracting party to the European Energy Community, which began in February 2022, has led to a significant decrease in natural gas supplies to the EU. The war in Ukraine has also created uncertainty regarding the supply of other commodities, such as top coal and crude oil, used by power generation facilities, thus leading to further substantial increases and, implicitly, volatility in electricity prices.

In this context, the European Commission decided that a coordinated response by the European Union Member States was needed and published the proposal for an Emergency Intervention Regulation on energy prices on 14 September 2022 (EC, 2022; EPG, 2022). According to the Commission, uncoordinated national measures could affect the functioning of the internal energy market, endangering security of supply and leading to further price increases in the Member States most affected by the crisis.

After a series of debates and some amendments, on October 6, 2022 the Regulation was published in the Official Journal of the Union Council Regulation (EU) 2022/1854 - ***Regulation (EU) 2022/1854 on emergency intervention to address high energy prices.***

The regulation includes the following measures (EPG, 2022):

- ✓ Reducing electricity demand in EU Member States;
- ✓ Capping market revenues for electricity production from infra-marginal technologies;
- ✓ Temporary solidarity contribution from oil, natural gas, coal and refining companies.

To understand the general context of the tax regime specific to the oil and gas sector in Romania, we further detail these three measures from Regulation (EU) 2022/1854.

➢***Reducing electricity demand***

For the period from December 1, 2022 to March 31, 2023, the Regulation provides:

- Optional reduction of the total monthly gross electricity consumption by 10% compared to the average gross electricity consumption in the corresponding months of the reference period.

- Mandatory reduction of total electricity consumption during peak hours identified by Member States by at least 5% on average per hour. The reduction target will be calculated as the difference between the total electricity consumption during the identified peak hours and the total consumption expected by the transmission system operator in the absence of the reduction measures introduced.

- In the version published in the Official Journal of the Union, the provision was introduced according to which EU Member States may choose to target a percentage of peak hours different from the peak hours corresponding in total to a percentage of at least 10% of the total number of hours from 1 December 2022 to 31 March 2023, provided that it covers at least 3% of peak hours and energy saved under the conditions presented above.

➢ ***Capping market revenues for electricity production from infra-marginal technologies***

- Producers' market revenues obtained from electricity production are capped at a maximum of 180 euros/MWh.

- The obligation applies to producers of electricity from the following sources: wind energy; solar energy (thermal and photovoltaic); geothermal energy; non-reserved hydroelectric energy; biomass fuels (solid or gaseous), except bio-methane; waste; nuclear energy, lignite, crude oil products and peat.
- Member States may maintain or introduce measures that further limit producers' market revenues, provided that such measures are proportionate and non-discriminatory, do not jeopardise investment signals, ensure the coverage of investment costs, do not distort the functioning of wholesale electricity markets (FIC, 2021) and are compatible with European Union law (Biris, 2023).
- The cap targets all market revenues of producers regardless of the market time frame in which the transaction takes place and regardless of whether electricity is traded bilaterally or on a centralized market, in order not to encourage the migration of transactions to certain segments of the wholesale market.

➢ ***Temporary solidarity contribution from oil, gas, coal and refining companies***

- The solidarity contribution applies to companies with activities in the oil, gas, coal and refining sectors, which generate at least 75% of their turnover, unless Member States have already adopted equivalent national measures.
- The temporary solidarity contribution is calculated based on taxable profits that exceed a 20% increase in 2022 and/or 2023 compared to the average taxable profits in the four financial years starting from January 1, 2018.
- The applicable rate for calculating the temporary solidarity contribution is at least 33% of the taxable base calculated by reference to the excess taxable profits determined in accordance with the provisions of the Regulation. This applies only to excess profits generated in the financial year that began on 1 January 2022 and/or 1 January 2023 and for its entire duration.
- If the average annual result of the period covering the four financial years is negative, the average taxable profit is zero for the purpose of calculating the temporary solidarity contribution.
- This contribution applies in addition to generally applicable taxes and fees under national law.

Methodology and data: the specific fiscal regime in the oil and gas sector in Romania

Both in Romania and in other European countries we encounter royalties, taxes, duties or additional contributions applied to the oil and gas industry in conjunction with the general taxation rules specific to each state. Therefore, the tax environment applicable to companies in Romania operating in the oil and gas industry consists of (Deloitte, 2018b; 2018c; EPG, 2019; PwC, 2021; FPPG, 2022):

✓ *the general taxation system, such as:*

- corporate tax;
- income tax;

- VAT;
- excise duties;
- customs;
- local taxes and fees;

✓ *sector-specific taxation system (i.e. oil and gas), such as:*
- oil royalties due for the production of crude oil and natural gas;
- taxes on additional income from the sale of onshore, offshore and deep onshore natural gas;
- additional tax applicable to crude oil production;
- contributions due for electricity production in power plants owned by oil agreement holders;
- contributions due by oil agreement holders for natural gas and electricity trading activity;
- the reduction of 0.25 lei/liter borne by companies in the sector for gasoline and diesel sales;
- other sector-specific contributions.

The following is a broad outline of the taxation system specific to the oil and natural gas sector, currently consisting of the following legislative regulations in force:

➢ ***Petroleum royalty*** (Law no. 238/2004):

- The law requires oil agreement holders to pay an oil royalty to the state budget;

- The royalty rates currently applicable are between 3.5% and 13% for natural gas and between 3.5% and 13.5% for crude oil depending on the amount of gross production extracted per quarter;

- Oil royalties are calculated based on reference prices established by the competent authorities and are due on the 25th of the first month of the following quarter;

- The reference price of natural gas used for the calculation of royalties is determined based on the Day Ahead price of the CEGH hub in Baumgarten, Austria, in accordance with ANRM Order No. 32/2018, which recorded values significantly higher than the average prices achieved by natural gas producers in Romania (we will return to this topic in the chapter dedicated to the analysis of royalties in the oil industry).

➢ ***Tax on additional income from the sale of natural gas from onshore production*** (Government Ordinance no. 7/2013):

- The tax is calculated by applying a rate of 60% for income between 45.71 lei/MWh, adjusted by the CPI rate, and 85 lei/MWh, respectively 80% for income exceeding 85 lei/MWh.

- From the tax calculation base, royalties due for additional income as well as investments in the upstream sector of a maximum of 30% of additional income are deducted, to which tax rates of 60% and 80% are applied.

- The tax on additional income represents a deductible expense when determining taxable profit.

- The additional revenue is determined as the difference between (1) the weighted average price of natural gas sold from own domestic offshore and/or deep-sea onshore production, from which the costs of transportation, distribution, storage and other logistical costs borne by the petroleum agreement holder are deducted, and (2) the minimum base price of the calculation interval corresponding to the price grid starting from 85 lei/MWh, multiplied by the volume of gas sold from own domestic offshore and/or deep-sea onshore production.
- The percentage rates applied to additional income for the purpose of determining the tax range from 15% to 70% depending on the price charged. Starting with January 1, 2019, the price thresholds used for calculating the tax are adjusted each year, using the annual consumer price index.

➢ ***Tax on additional income from the sale of natural gas from offshore and/or onshore deep-water production*** (Law no. 256/2018 republished with the amendments to Law no. 157/2022 – "Offshore Law"):

- The so-called Offshore Law was amended in May 2022 with the aim of ensuring predictability, stability and unlocking investments in the Black Sea [Deloitte, 2018a].
- The tax on additional income from the sale of natural gas from offshore production applies to the targeted companies starting from November 2018, thus the amendments to Law No. 157/2022 refer to the tax base, the limit on the deductibility of investments when calculating profit tax and the application of these taxes also in the sphere of onshore deep-water production.
- The legislative framework provides for the obligation of entities holding offshore, deep-sea onshore petroleum agreements and those relating to these areas, including their subsidiaries, to calculate, declare and pay tax on additional income.
- The tax on additional income will represent a deductible expense when determining the fiscal result for profit tax.
- The taxpayer can also deduct his investment in the upstream segment up to 40% of the total additional income tax.
- The royalty regime and the tax regime applicable to exploration, development, exploitation and abandonment activities will not change during the application of the petroleum agreements, if they have been introduced in the petroleum agreements.

➢ ***Tax applicable to crude oil production***(Government Ordinance no. 6/2013 on the establishment of special measures for the taxation of the exploitation of natural resources, other than natural gas):

- This tax is calculated by applying a rate of 0.5% of the revenues from the exploitation of crude oil production, including in the situation where oil agreement holders process crude oil in their own refinery.

- The amounts related to this tax represent, for economic operators in the extraction of crude oil (CAEN code 0610), deductible expenses when determining taxable profit, under the provisions of Law No. 571/2003 on the Fiscal Code, with subsequent amendments and supplements.

➢ ***Capping natural gas prices for natural gas sales made by oil agreement holders and the contribution to the Energy Transition Fund*** (GEO no. 27/2022 amended by GEO no. 119/2022)

- Natural gas producers are obliged to make available, to suppliers of household customers and those of thermal energy producers, the quantities of natural gas from their own production, calculated according to Annex 5 of GEO no. 27/2022, at a price of 150 lei/MWh. For the production of electricity in their own natural gas-fired power plants, an internal transfer price (for example, within the same legal entity) of a maximum of 100 lei/MWh is established.

- Contribution to the Energy Transition Fund for electricity production, applicable including to holders of petroleum agreements who own electricity production plants by burning natural gas, which has a 100% share of revenues from the sale of electricity exceeding 450 lei/MWh and the cost of CO_2 certificates. During the period 01.04.2022 - 31.08.2022, a similar contribution of 80% was applicable for electricity production from natural gas-fired plants.

- The contribution to the Energy Transition Fund for the electricity and natural gas trading activity, calculated as the difference between the average monthly selling price and the average monthly purchasing price, imposes a quota of only 2% to cover the rest of the operators' expenses and possibly achieve a profit margin (Annex 6.1 of GEO 27/2022 amended by GEO 119/2022 starting with 01.09.2022).

➢ ***Contribution for reducing gasoline and diesel prices*** (GEO no. 106/2022):

- During the period 1 July-30 September 2022 (later extended until 31 December 2022), economic operators that sell gasoline and diesel to end customers - natural and legal persons who purchase fuels from warehouses and/or distribution stations for their own consumption -, and that grant a price reduction of 0.5 lei/liter, including VAT, on the selling price, benefit from the state budget from a compensation of 0.25 lei/liter, including VAT, related to the discount granted. For fractions of a liter, the price reduction and the compensation, respectively, were granted proportionally.

- The compensation measure provided for in the GEO was applied for the sale of gasoline and diesel to final customers for their own consumption, both at retail and at wholesale through suppliers'/distributors' warehouses.

➢ ***Contribution due by license holders*** (GEO no. 114/2018 amended by GEO no. 1/2020):

- Starting with January 2020, the level of contributions of license holders in the field of electricity and natural gas is established annually by order of the president of ANRE (i.e. Order no. 143/2021 in force for 2022).

At the end of this paragraph, we must emphasize that it can be observed that **royalties** and **taxes on additional income** contribute in a similar proportion to the specific taxation of the upstream natural gas sector in Romania.

At the same time, we must mention that these taxes are applied additionally, cumulatively with the common taxation system (profit tax, VAT, excise duties, local taxes and fees, etc.), so that the oil and gas upstream activity records significantly ***higher costs of taxes and fees paid*** and ***administrative and compliance costs*** **than in the case of companies operating in common activities (trade, generic services, etc.)**.

Discussions: characterization of the specific taxation system applied to the oil and gas sector in Romania

Considering the concrete aspects related to its evolution and effects during the period 2013-2023, the taxation system in the upstream natural gas sector in Romania can be characterized by the following:

- ***Complete lack of stability and predictability.***

In the last 10 years, over 20 regulatory acts have been identified with an impact on the upstream natural gas sector, bringing important changes, including:

- ✓ Introduction and permanentization of the tax on additional income following deregulation.
- ✓ Introducing an increased rate and limiting the investment deduction in terms of additional income tax.
- ✓ Introducing tax on additional offshore income and limiting the deductibility of investments for corporate tax.
- ✓ Changing the reference price for calculating royalties.
- ✓ Introduction and elimination of construction tax.

Thus, not only can we not characterize the taxation system as stable or predictable, but it seems that the state authorities have made it a goal to **(i) make frequent and significant changes that conflict with the very original purpose of the law** (such as: making a transitory tax permanent,establishing an *additional tax* for offshore activity through legislation whose initial purpose was *to encourage the activity* , given that the level of royalties in Romania - calculated at a rate of 13% - was alsois still among the highest, compared to similar offshore jurisdictions, reversing the trend of market liberalization) and from **(ii) making sudden changes, which do not allow for multi-annual planning (characteristic and necessary for the upstream natural gas sector)** .

In the context where fiscal competition is taking place at the international level in order to attract investments, it is expected that the lack of stability and predictability in the Romanian tax system will lead to a decrease in Romania's attractiveness as an investment destination.

Romania's international **reputation** can be raised. In the offshore field, **the introduction of the new tax on additional income came after significant investments were made, commercially viable perimeters were identified and exploitation intentions were announced in the coming periods**. Thus, it seems that Romania confirms, once again, that it iswilling to change the rules mid-game, as it has done in other areas (e.g. renewable energy). In light of these changes, it is expected that Romania will not have a positive reputation (not being

a credible, reliable partner), which affects opportunities in terms of attracting investments in the future.

- ***Paradoxical policy in the offshore field, lack of correlation between the level of risk/difficulty of exploitation and the taxation regime***

If at a global level a correlation is observed between the difficulty of exploitation, on the one hand, and the level of taxation on the other hand, in the sense that more advantageous taxation systems are practiced to encourage more difficult exploitations (with higher investments and higher risk), **in Romania, however, the situation is paradoxically opposite, offshore exploitations (usually more difficult and riskier, requiring higher investments), suffer a higher effective tax burden than in the case of onshore exploitations and in any case approximately 5 times higher than the average of countries with a predominantly offshore specificity in 2021 and 2022.**

Moreover, in its current form, the offshore tax regime generates a total government take of *approximately 90%* of the profits generated by a standard offshore oil or gas project.

The Romanian tax system is thus one that effectively **discourages** future offshore investments. In the context in which (i) national natural gas production has suffered considerable declines as the existing conventional deposits are gradually exploited and depleted, and (ii) specialists estimate that maintaining or even increasing national production could be achieved substantially only through offshore deposits, **it is expected that the current tax system will lead to (i) discouraging offshore investments, (ii) limiting activity to mature onshore deposits in production, with a high degree of depletion and sharp decline, and, implicitly, to (iii) decreasing national production and increasing dependence on imports.**

Moreover, in general, it can be observed that the system of royalties and additional taxation is not differentiated according to the difficulty of exploitation or according to the techniques used, there being no incentive to encourage them. Therefore, also from this perspective, Romania seems to be one step behind.

- ***The trend of slowing down/reversing the market liberalization process***

The introduction of price caps for the sale of natural gas clearly represents a step backwards in the trend towards price liberalisation. The effects are the usual ones for such measures: distorting the incentive system of economic agents (discouraging them, in this case), and the decision-making system of consumers (encouraging them to rely on a certain energy consumption and certain technologies through artificially low prices).

- ***Technical deficiencies***

Leaving aside the macro reasoning and the opportunity for introducing certain measures, we appreciate that, in certain distinct cases, the implementation of the measures itself leaves much to be desired.

The change in the reference base for calculating royalties is, in our view, criticizable from a strictly technical perspective, as this reference is unrepresentative of local market conditions.

Setting an irrelevant reference (at the time of decision-making, at a higher level than that of the local market) signals that obtaining higher revenues for the state budget is more important than encouraging market development based on the principle of market value.

Using a reference price from a foreign market (irrelevant to the local market) for the purpose of calculating royalties contradicts:

- **The principle of fairness of taxation in the Fiscal Code**, which ensures that the tax burden of each taxpayer is established based on the contributory power, respectively depending on the size of the income. Given that the CEGH price is not related to the local market (in some cases being over 50% higher than local prices, in other cases up to 24% lower than local prices - we will return to this topic in detail later) **the taxation is carried out arbitrarily by reference to *unrealized income*, orby referring to only *a part of the income achieved***. Under these conditions, we cannot talk about imposing ***additional income*** (according to the reasoning and purpose of the law), income being defined strictly from an accounting perspective, as *increases in economic benefits* (or, these economic benefits can only be equal to the actual price achieved).

- **The practice at European level**, where reference prices are set exclusively by reference to relevant local references [Deloitte, 2018d].

Also, even if it is appreciated *that* the new taxes on additional income contain elements of taxation based on profitability (as they contain components of deductions of investments made), the modern approach being the combination of royalty elements with elements of taxation related to the profitability of projects, **however, we appreciate that this intention was poorly implemented from an administrative technique perspective.**

It can be seen that, worldwide, taxation systems in the *upstream* oil and gas sector are made up of several elements, a common approach being the combination of royalties (with immediate effect), with taxation that takes into account *the profitability* of exploitation (with long-term effect). This combination ensures a reasonable balance, an alignment between the constant and immediate needs of the state and the needs of the taxpayer to correlate the tax due with the profitability of his projects.

However, taxes on additional income in Romania still do not act as true taxes on profitability since, as a direct effect of the calculation method, producers owe and pay this tax even before the investment is recovered (investment deductions being limited, producers owe and pay tax from the very beginning).

Moreover, the introduction of these taxes should have coincided with the reduction of the royalty amount, in such a way as to maintain the total level of taxation on the project, but with a different temporal allocation over the duration of the project: first, royalties would be paid, and over time, the tax on additional income would increase in importance.

On the contrary, additional taxes were added to the royalties owed, completely increasing the level of taxation from the very beginning.

In international practice, *additional taxes* are usually applied to sales prices considered surplus, for producers who make an excess profit (i.e., above a level considered normal for the sector).

By **limiting the deductibility of offshore investments from a profit tax perspective** (specifically, by reducing deductible expenses with tax depreciation of investments made), the

tax base of offshore producers is artificially broadened, compared to the rest of the economic agents in Romania.

This approach is contrary to the practice at European level, where specific taxation in the upstream sector with profitability elements is (i) similar to the mechanism applied to other sectors of activity and/or (ii) contains measures to encourage investment (e.g. faster deduction, over-deduction of investments, etc.).

Since the formula for calculating income subject to the additional offshore tax does not allow for the deduction of royalties related to this income, we consider that double taxation of *additional income* (royalties, followed by tax on additional income) is generated.

The deductibility of investments to a maximum of 30% of the additional revenues recorded (up to 85 lei/MWh), modified only by Law no. 157/2022 of May 25, 2022 (which, among other things, eliminated the over-taxation below the threshold of 85 lei/MWh and increased the limit for deducting investments from the additional tax, from 30% to 40%, also reiterating the stability guarantee, in the sense that there will be no more tax increases or new taxes, *a "guarantee"* included, moreover, in Law no. 256/2018) discourages onshore investment projects with high costs or risks (for example, exploration or deep-sea wells).

However, it would be wrong to say that these measures are completely incoherent. On the contrary, the specific taxation system of the upstream natural gas sector in Romania brilliantly fulfills the objective (the only one, in fact) for which it was designed: that of generating additional budgetary revenues *in the short term*. In light of this single objective, it is explained why the effective tax rate in Romania has become by far the highest among the European countries analyzed, as well as the recent increases in specific taxes and fees collected, at a pace significantly disproportionate to the evolution of revenues in this area.

The problem is that these additional budget revenues came at the cost of (i) discouraging future investments and (ii) discouraging local production (with, of course, reducing energy independence and increasing dependence on imports).

It is clear that, as future production is discouraged and will continue its inevitable decline, state budget revenues will also decline.

At the same time, it is obvious that the other possible objectives were not taken into account when the measures that led to the current form of the taxation system were taken, namely (we will detail below):

- ***Employment***

The number of employees depends on the scale of the activities. In a taxation system with a tendency to increase the tax burden, investors will concentrate their activities in projects with the highest and most reliable returns.

- ***The environment***

From the analysis carried out, no measure based on environmental criteria was identified. On the contrary, as natural gas is an important factor in the energy mix that contributes to a reduction of greenhouse gases, **discouraging investments and production of natural gas may indirectly encourage the consumption of other energy sources** (relatively more harmful to the environment from a greenhouse gas perspective, such as oil, and especially coal).

➢ ***Energy security***

The current taxation system acts contrary to the objective of energy security, having the effect of discouraging local production and encouraging imports (a fact already observable by the increase in natural gas imports in 2019).

The current taxation system of the upstream natural gas sector is, therefore, eminently one oriented towards achieving short-term budgetary revenues, which does not bring a balance between the needs of the present and those of the future, being unsustainable in the long term. For these reasons, in the following paragraph we will try to identify some measures to improve the current taxation system in the oil industry in our country.

Results: System improvement measures

Given the identified deficiencies, and in the sense of bringing a balance between: **(i) the needs of the present and those of the future**, **(ii) the budgetary needs of the state and the other strategic objectives**, respectively **(iii) the needs of the state and those of investors,**we believe that the following measures could have potential beneficial effects:

➢ ***Reducing the effective tax burden.***

Through this reduction, to a level closer to the average of European countries, competitiveness can be improved, in order to encourage investment and production in Romania.

Correlating taxation with the degree of difficulty and risk of exploitation, in the sense of encouragement, through a more favourable tax regime, related to more difficult exploitations (for example, lower taxation for offshore and for onshore exploitations that require improved techniques compared to conventional techniques, such as deep-sea ones, etc.).

➢ ***Increasing the degree of correlation of taxation with the profitability of exploitation projects.***

Even though the taxation system in the upstream field of natural gas should not be based exclusively on the profitability of the producer, **a consumption of finite resources is recorded regardless of the outcome.this consumption**, the taxation system must be the result of a compromise between the constant and immediate needs of the state and the effective profitability of the projects.

This compromise could be achieved by implementing a system consisting of royalties (relatively constant budget revenues, throughout the duration of production) alongside a tax linked to profitability (with the admission of initial losses, including those in the exploration phase), which generates longer-term revenues.

Specifically, taxes on additional income should allow for losses from the initial phases, the full deduction of investments made, so that additional taxes are due starting with the full recovery of the investment by the producer.

From an employment perspective, perhaps the highest impact could be achieved by significantly reducing or eliminating specific taxation for small or low-yield projects, which would encourage the expansion of lower-yield activities, which are currently not a priority for large investors.

From an environmental perspective, encouraging the production and consumption of natural gas (at the expense of other more polluting sources) is itself expected to have a positive effect on the environment, due to the relatively low greenhouse gas emissions.

Significant elimination/reduction of the **2% contribution established by GEO no. 114/2018 on the turnover related to operations subject to ANRE licenses**[Deloitte, 2019], which is currently levied *for ANRE financing* (previously ANRE managed to obtain adequate financing through a tax of approximately 20times lower).

- ***Adoption of market-relevant reference prices.***

For the proper functioning of the reference price mechanism for calculating the royalty, we consider that (i) it must be established by reference to the specifics of transactions related to local production (mostly long-term supply contracts, not spot) and (ii) it must represent a relevant level, which can be **the weighted average of pricesregistered on the local market during the reference period.**

The opportunity for a possible correlation of the market value principle in the matter of profit tax with the value used to calculate the value of production from the perspective of royalties could also be analyzed (the value of production could be calculated by reference to the prices achieved by producers when they fall within the market range, otherwise, the value of production would be calculated by reference to the median of the market range (which would act, de facto, as a reference price).

- ***Ensuring stability/predictability for existing and potential investors.***

Last but not least, it should be noted that **legislative changes are imperative to ensure stability/predictability for existing and potential investors.** The taxation system must not only be brought to a balanced and sustainable stage, it must also be maintained over time, through appropriate stability clauses, ensuring a stable legislative framework for long-term and very long-term investments such as those in the oil and gas industry (the applicable tax regime should remain the one from the moment of the start of the investments/exploitation).

Conclusions

The results of this analysis reveal the growing importance of the oil and gas sector in the economy. This comes at a time when global energy prices are at high levels, and Europe in particular is facing higher natural gas and electricity prices, largely amplified by the conflict in Ukraine.

At the end of this analysis of the specific tax regime applied to the oil and gas sector in Romania, several ***conclusions*** can be drawn, namely:

- The current context is unprecedented, both at the global, regional and local levels and requires intervention measures, but these must be balanced so as to ensure energy security, protect vulnerable consumers, not discourage investments and at the same time allow the proper functioning of the energy market.
- Regulation (EU) 2022/1854 on emergency intervention to address high energy prices comes with a series of measures that must be respected in the process of reviewing national policies in force.
- At the same time, a series of national particularities and implicitly the current blockages determined by GEO 119/2022 [Concordia, 2022] must be taken into account, such as the calculation of the royalty: for quantities transferred at a regulated price for the electricity production activity, it is necessary that the royalty be calculated at the regulated price and not at the price established on a market other than the local one, significantly higher than the regulated price.
- Contribution to the Energy Transition Fund for electricity and natural gas trading activity: it must be clarified which costs are covered in the category of acquisition costs (e.g. costs incurred to bring the goods to market), otherwise the current provisions constitute a ban on imports given that the margin cannot exceed the 2% threshold.
- Thus, the implementation of the measures of the EU Regulation should be carried out simultaneously with the revision of national legislation in order to ensure the proper functioning of the energy market. Moreover, the application of the solidarity contribution under the EU Regulation should be analyzed in the context of the national fiscal regime and implicitly in terms of its impact on investments in the sector. Romania's decision to introduce the solidarity contribution, including on which financial year or financial years it will apply, was communicated to the European Commission by 31 December 2022, according to the Regulation.

Given that Romania has already implemented a series of national measures presented in our analysis, the Romanian authorities should take them into account and analyze to what extent they are equivalent to the solidarity contribution proposed by the Regulation.

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THE SUSTAINABLE NATURE OF FISCAL AND BUDGETARY CONSOLIDATION FROM A LOGICAL AND INSTITUTIONAL PERSPECTIVE

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Abstract:

The article investigates the sustainability of fiscal consolidation from a dual perspective: logical-economic and institutional, with a focus on the interaction between fiscal adjustment strategies and the broader governance framework. The study goes beyond the restrictive accounting approach of consolidation, arguing that sustainability depends both on the logical coherence of fiscal policy design and on the institutional robustness of implementation mechanisms.

Methodologically, the analysis combines the conceptual assessment of the logical consistency of fiscal rules with an empirical examination of the institutional arrangements that shape budgetary outcomes in Romania and the European Union.

The results show that sustainable consolidation involves more than meeting deficit and debt thresholds: it depends on the credibility of tax institutions, administrative capacity and the integration of fiscal strategies into long-term growth and social resilience objectives. Moreover, research suggests that credible institutions and rule-based frameworks reduce procyclical biases and increase fiscal discipline, while fragile governance erodes the effectiveness of consolidation efforts.

The contribution of the article is to articulate a bridge between the logical models of fiscal coherence and the institutional economics of governance, highlighting the need for gradual consolidation strategies, anchored in clear and institutionally integrated rules.

Keywords: *fiscal consolidation and sustainability; institutional governance; fiscal policies; fiscal rules; European Union; Romania*

JEL classification: *E62, H60, H83*

Introduction

This article investigates the sustainability of fiscal consolidation from a dual perspective – logical-economic and institutional – aiming to highlight how fiscal rule design and institutional robustness intersect to shape fiscal outcomes.

The topic is topical because fiscal consolidation is a global priority in the context of post-pandemic imbalances, the green transition, the technological revolution 5.0 and demographic pressures. Its sustainability analysis, from a logical and institutional perspective, is essential for macroeconomic stability and the credibility of public policies, both globally and in the EU. Sustainable fiscal consolidation becomes essential for economies marked by high public

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debt, green and digital transitions, inflationary pressures and increased social needs. The logical and institutional analysis makes it possible to assess the coherence of EU policies and, in particular, Romania's ability to ensure long-term stability.

Armed conflicts and current geostrategic approaches play a major role in shaping the sustainability of fiscal consolidation, by amplifying economic uncertainties, increasing military spending and affecting trade and energy flows. They lead to the reconfiguration of fiscal priorities, emphasizing the need for prudent and institutionally resilient fiscal policies. The issue of fiscal consolidation becomes central in Romania: i) in the context of the pressures generated by the recent economic crises, by the structural transitions; ii) under the imperative of the need to align with the European objectives of stability and sustainable development, iii) for the effective governance of national security.

It follows that beyond an accounting understanding of fiscal adjustment, its sustainability requires a multidimensional analysis, which captures both the logical coherence of fiscal rules and the institutional resilience of the implementation mechanisms.

In the European Union, fiscal consolidation is often viewed in terms of compliance with deficit and debt thresholds. Macroeconomic imbalances, such as budget deficits and persistent inflation, are analysed in the ESA 2010, which provides a key European statistical framework for assessing economic performance and comparability of data between Member States. The experience of recent decades shows that these criteria are not sufficient to guarantee a sustainable trajectory.

Romania illustrates the difficulties and paradoxes of consolidation: rapid but often procyclical adjustments, strained by institutional constraints and a fragile governance framework.

The article advocates defining fiscal consolidation as reducing the deficit relative to GDP, stressing the importance of expressing it in relative terms to allow comparisons in time and space and to integrate European convergence criteria (such as the Maastricht Treaty). This is a contribution that provides a solid basis for debates on the sustainability of fiscal consolidation and the implementation of new mathematical and institutional models.

Literature Review

The existing literature suggests that the success of consolidation policies depends not only on traditional macroeconomic parameters, but also on the quality of institutions, the coherence of fiscal rules, and the state's ability to adapt strategies in the context of external shocks (Alesina & Ardagna, 2010; IMF, 2023).

This section reviews the relevant literature at three levels: (i) theoretical frameworks and models for assessing fiscal sustainability; (ii) institutional and regulatory perspectives, with a focus on the European Union; and (iii) external shocks (e.g. effects of geopolitical and military decisions) on fiscal consolidation. Finally, the conceptual implications for Romania are discussed.

i)Theoretical frameworks and models of fiscal sustainability

The assessment of fiscal sustainability was initially approached through simple debt accumulation models and arithmetic debt sustainability relationships, in which public debt is analyzed in terms of economic growth, interest rates and primary deficit (Bohn, 1998; Elmendorf & Mankiw, 1999). These models, although useful for diagnosis, can be criticized for optimistic assumptions regarding the output-gap, the stability of macroeconomic parameters and the ignorance of institutional interdependencies.

In recent decades, the literature has advanced towards Debt Sustainability Analysis (DSA), combining macroeconomic scenarios and stochastic simulations. Recent analyses integrate risks of external shocks, structural vulnerabilities and distributional effects, revealing that simply reducing the deficit does not guarantee long-term sustainability (IMF, 2023; European Commission, 2022a). For example, comparative studies show that countries with credible fiscal institutions can sustain higher levels of debt without compromising stability, while states with weak governance risk losing market confidence and increasing financing costs (Afonso et al., 2006).

In parallel, the literature underlines the importance of the composition of consolidation: adjustments based on increasing public revenues are more sustainable and less damaging to economic growth than those based solely on reducing spending. However, the integration of spending for the green and digital transition or for national security raises the complexity of sustainability assessment, requiring more sophisticated scenarios.

ii) Institutional perspectives and regulations in the European Union

At European level, the literature highlights the role of institutional frameworks in the success of consolidations. The EU's fiscal rules, revised after the sovereign debt crisis and the COVID-19 pandemic, aim to balance fiscal discipline with the necessary flexibility for strategic public investment (European Commission, 2022b). Recent studies emphasize that the effectiveness of rules depends on their consistency with national strategies and the ability of institutions to monitor and sanction slippages (Hallerberg, M & von Hagen, J, 1999; Von Hagen & Harden, J., 2019; Regling, K., 2022).

Moreover, the literature highlights the interdependence between fiscal rules and growth policies: rigid consolidations that do not take into account strategic investments can compromise competitiveness in the long term, while flexible frameworks allow fiscal discipline to be maintained without affecting structural objectives (European Fiscal Board, 2023). Thus, the EU framework becomes a tool for assessing sustainability, not only in terms of traditional financial indicators, but also in terms of institutional coherence and strategic priorities.

iii) Impact of external shocks

The emerging literature highlights that external shocks — including armed conflicts and geopolitical tensions — significantly influence fiscal consolidation. Military spending increases pressure on public budgets, reducing the fiscal space available for other strategic and social investments (OECD, 2023). Conflicts also affect trade flows, financial market stability, and energy security, which can lead to unexpected and temporarily unsustainable fiscal adjustments (IMF, 2023).

Recent models suggest that integrating geopolitical risks into DSA scenarios allows for a more realistic assessment of sustainability. For example, macro-fiscal simulations for EU states show that persistent increases in defence spending, combined with investments for the green transition, can strain the fiscal balance, requiring flexible and coordinated policies at supranational level (European Parliament, 2025).

Thus, the literature highlights the need for a balance between fiscal discipline, national security and strategic investments, stressing that ignoring the geopolitical dimension can turn seemingly sustainable consolidations into vulnerabilities in the medium term.

In the Romanian context, the literature emphasizes that the success of consolidations depends on: i) the quality of fiscal institutions and fiscal governance — credible institutions and transparent fiscal rules increase investor confidence and facilitate sustainable

adjustments (Popa & Grosu, 2020); ii) composition of adjustment — revenue-based measures are more compatible with economic growth, while indiscriminate cuts in social spending can generate long-term adverse effects, iii) ***coherence with strategic priorities*** — Romania is in simultaneous transition to the green economy, digitalisation and defence capacity building; the literature highlights that fragmented or reactive fiscal policies risk undermining sustainability (Iancu, 2022); iv) resilience to external shocks — recent geopolitical and economic shocks require flexible scenarios and medium-term planning to ensure the continuity of critical investments.

Thus, the conceptual literature suggests that the sustainability of consolidation in Romania cannot be assessed only by traditional indicators (deficit/debt), but by an integrated approach that combines fiscal governance, strategic coherence and resilience to external shocks.

Therefore, the proposed research can contribute to filling methodological and conceptual gaps, providing through the logical method an integrated framework combining fiscal-budgetary, institutional and geopolitical analysis for the assessment of sustainability in the medium and long term.

Description of the Problem

The questions that the research seeks answers to are:

1. What does sustainable fiscal consolidation mean?

2. What are its logical and institutional limits?

3. How do Romania and the EU position themselves in this context?

Typically, fiscal consolidation means the reduction of the budget deficit from the actual state to the predetermined state (either institutionally or operationally). An important feature is the obligation, regardless of the way the final target is set, respectively the fiscal consolidation process cannot fail to occur, from the perspective of economic and regulatory action.

In accordance with the most significant programmatic documents of the European Union: the Maastricht Treaty, the Stability and Growth Pact, the Fiscal Compact, we are talking about sustainable fiscal consolidation at the maximum value of the budget deficit of 3% of GDP and the debt of 60% of GDP. Although these thresholds, which are very present in analyses and even public and political debates, have remained unchanged, their significance and the way of assessing the progress made towards achieving them have undergone extensive conceptual changes through the reform of the European Union's economic governance framework.

Methodology and Data

The study uses a methodological combination [1] that allows the articulation of an integrated perspective, which captures not only the formal rules, but also the institutional context in which they operate:

-conceptual assessment of the logical consistency of fiscal rules, by analysing the European framework and national adaptations, in relation to macroeconomic and social objectives,

-empirical analysis of institutional arrangements, using:

1. comparative data on tax governance in the European Union;

2. case studies for Romania and other emerging economies;
3. fiscal sustainability indicators (structural deficit, cyclically adjusted public debt, public investment expenditure).

Contextual framework:

▪ Romania registers significant deviations in the budget deficit compared to the 3% threshold established by the Maastricht Treaty, as shown in Figure 1.

Figure 1: Budget deficit situation in Romania in the last 10 years

Source: Eurostat and own calculations

The reference year for calculations is 2014, when the budget deficit was 1.2%. A smoothed annual rate means the rate that would have been recorded if the average annual rate for the analyzed period (i.e. 22.7%) had been applied for each year.

The following observations can be extracted from Figure 1: i) the budget deficit complied with the condition of the Maastricht Treaty only for the period 2015 – 2018; ii) starting with 2019, the benchmark in question is exceeded, even by a high rate (by 43%), and in 2020 the exceedance rate becomes 207% - the same exceedance rate will occur in 2024, i.e. 210%; iii) in 2020, Romania has already entered the excessive budget deficit procedure, as a result of the relative budget deficit of 4.3% reached in 2019; there are two episodes of fiscal consolidation, of course, without returning to the EU benchmark, in 2021 (year-on-year rate: -23%) and 2022 (year-on-year rate: -10%);

The EU's forecast for 2025 is 8.6%, and for 2026 it is 8.4%. (EU, Spring 2025 Economic Forecast). The EU expects a fiscal consolidation process to start in 2025, with the following annual consolidation rates: -7.5% in 2025 compared to 2024 and 2.3% in 2026 compared to 2025.

▪New European governance regulations enter into force in April 2024, the benchmarks

of the Treaty on the Functioning of the EU – TFEU being maintained, namely the 3% ceiling

for the relative deficit of the consolidated general budget and the 60% ceiling for the total relative public debt. Failure to comply with these ceilings implies a process of adjustment of public finances over a period of four years or, if the country concerned commits to structural reforms (including through public investment), the adjustment period may be extended up to seven years. In the case of Romania, it is a period of adjustment of public finances, a period of fiscal consolidation of seven years, i.e. the period 2025 – 2031.

- In October 2024, Romania drew up its first Medium-Term Structural Budgetary Plan,

approved by ECOFIN with 5 objectives: i) including the trajectories in the 7 years within the ceilings established by the Maastricht Treaty: 3% budget deficit; 60% of the total public debt; ii) in 2031the effective achievement, at the end, of the value of 2.5% of the relative budget deficit; iii) starting with 2029 the introduction of a public finance model in which the state's operating expenses do not generate a budget deficit (they are fully covered by the collected tax revenues), so that the budget deficit is proportional to the investment expenditures); iv) correlation of the annual rates of public investments with the annual absorption rates of European funds; The estimates in terms of GDP are as follows: 2025: 7.9%; 2026: 7,7%; 2027: 6,5%; 2028-2031: 5%. Through the Cohesion Policy, 46 bln. euro, and through the Recovery and Resilience Mechanism 29.7 billion euros must be absorbed. euro; v) ensuring the predictability of the tax system, by increasing the share of current revenues of the consolidated general budget in GDP (from 29.6% in 2024 to 31.1% in 2031 – an increase of 5.2%, i.e. 1.53 pp).

Conceptual framework:

An in-depth analysis of the concept of fiscal consolidation starts from the theoretical foundation of the role of the state in ensuring public goods and services that the free market cannot produce or distribute efficiently. The distinction between material public goods, related to the standard of living and quality of life, and non-material goods, such as freedom or equity, is clarified. In this logic, the fiscal-budgetary structure of the state is defined, composed of the fiscal sub-structure (design and administration of public revenues) and the budgetary sub-structure (design and administration of public expenditures).

Describing in detail the mechanisms of the fiscal-budgetary binomial, one can observe and describe the statutory, functional, resilience and robustness benchmarks, which govern the relationship between revenues and expenditures and influence the level of the deficit differentiation of the types of budget deficit: objective (caused by actual expenditure needs), methodological (due to estimation errors) and administrative (resulting from the inability to collect revenue).

Thus, there is always a benchmark of the budget deficit, to which both the establishment of budget expenditures and that of budget revenues are aligned. In research I considered that this benchmark could be, first of all, a ceiling threshold and classified it as follows:

✓statutory *benchmark* (BS) – which is imposed by the external environment to the fiscal-budgetary process (Constitution, Public Finance Law, Treaties or other mandatory EU documents, etc.); In the case of Romania, which is a member state of the European Union, the statutory benchmark is provided for in the Maastricht Treaty, taken over in the Fiscal Compact, respectively in the Stability and Growth Pact – it has a value of 3% of GDP and is, as is known, one of the five nominal economic convergence criteria for joining the Eurozone (Economic and Monetary Union).

✓functional benchmark (BF) – which is established by the internal environment of the fiscal-budgetary process, (e.g. the National Committee for Macroprudential Oversight (NCMO)),

based on ex ante impact studies on the impact of the budget deficit on the two major macroeconomic variables: inflation and economic growth (in fact, employment);

✓resilience benchmark (BE) – which is established at government level (in consultation with the central bank) and which has the role of resolving a previous imbalance, i.e. it has an active role in macroeconomic dynamics (i.e. it has a role of predetermined fiscal-budgetary impulse); This is the case in Romania at the moment, where the strong overcoming of the budget deficit generated the need to conclude an agreement with the European Commission in order to consolidate fiscal consolidation in the next seven years (this is, therefore, the case study of the research, i.e. the testing of the hypothesis proposed in the study on the ordinance of sustainable fiscal consolidation).

✓robustness benchmark (BR) – which is determined at government level (in consultation with the central bank) and which has the role of obtaining budget surpluses to be hoarded in order to finance unfavourable fiscal situations in the future (this process is recommended by the EU, as well as by the various relevant international organisations in the economic and financial field, to ensure buffer funds or working capital, macroeconomic level in order to overcome critical situations in fiscal-budgetary matters).

We also raised the question of whether there should be a floor threshold in addition to the ceiling threshold and of course we analyzed it along the way, but it will be exposed in another work, in accordance with the logic of the research and the economy of this project presentation work.

On the cutting side, budget expenditure is a structural element of aggregate demand, so it functions as an impulse oriented towards economic growth. But economic growth generates increases in the tax bases in the economy which, even at the same tax rate, generate increases in budget revenues. Budget revenue, as the source of financing budgetary expenditure, also has a momentum effect: an increase in budget revenue can ensure an increase in budgetary expenditure or, most of the time, given that budgetary expenditure is rigid in the short term and sometimes even in the medium term (e.g. structural expenditure, i.e. mandatory/unavoidable, expenditures on programs), this increase is constituted in that specific reserve of the budget surplus, with a subsequent impact on both the budget revenues themselves and on the budget expenditure.

It follows from the above that there is a strong and permanent structural, functional and causal dependence between budget revenues and budget expenditures that influences the budget deficit.

From an operational point of view, there is its own, distinct mechanism in each of the components of the fiscal-budgetary binomial.

In the case of the tax process, the tax revenues – (the result variable of this process) is determined by the product of three variables: VF

•$VF = r \cdot b \cdot c$ (1)

where:

r - the tax rate is the variable of qualitative control (intensity),

b - the tax base is the quantitative order variable (extension),

c- the degree of collection of budgetary obligations is the structural (administrative) command variable.

If the variables and, obviously, are at the discretion of the state, the variable can be acted by both the decisions of the state and the decisions of the economic actors, the analysis of the functioning of the mechanism being accepted according to Dinga (2024).rcb

In the case of the budgetary process, the budgetary expenditure – (the result variable of this process) is determined by the product of three variables: CB

•$CB \equiv \beta = \alpha \cdot \gamma$ (2)

where:

β- the budget appropriation is the variable of the order of the possibility of spending;

α - the commitment appropriation is the variable of the order of necessity of the expenditure;

γ - the degree of absorption of budgetary expenditure is the structural (administrative) command variable, which ultimately refers to the capacity of the economy (in fact, of society as a whole) to effectively spend the public funds made available through the public budget. All three variables are at the discretion of the state.

The budget balance is determined as the accounting difference between tax revenues and budget expenditures, and starting from the value of the budget balance (regardless of whether it is surplus or deficit), feedback reactions are generated, both to the determinants of tax revenues and to those of budget expenditures, in an integrated mechanism that targets BFB as a whole.

Thus, co-evolutionary valences of the fiscal-budgetary binomial can be examined, such as:

▪directly, there are no causal relationships, from an accounting perspective, between tax revenues and budgetary expenditures; Mandatory budgetary expenditures are those budgetary expenditures that cannot be left out: salaries for the public sector, goods and services for the functioning of public institutions and authorities, national defense, public education and health, and the like. These expenditures can only be adjusted (e.g. reduced) if their substantiation basis is reduced (e.g. the number of employees in the public sector). Non-compulsory budgetary expenditure generally refers to public investments which, although useful, having a multiplier role at macroeconomic level, sometimes in the medium or long term (echo effect), can be reduced or even cancelled in certain justified circumstances.

▪indirectly, however, such causal relationships work by relating to the fiscal-budgetary multipliers. For example: an increase in the personal income tax rate will lead to a decrease in national income (measured by GDP), in which case the tax multiplier is negative; an increase in government (budgetary) spending by one unit leads to an increase in national income (GDP) by a number of units equal to the inverse of the marginal inclination to save. Unlike the case of the fiscal multiplier in which the variation of the command variable (personal income tax) led to an opposite variation of GDP, in the case of the budgetary multiplier, the variation of the command variable (budgetary expenditures) leads to a variation in the same direction of GDP.

A relationship that arouses a lot of emotion is: budget deficit - public debt that also produces negative expectations. When the budget deficit appears at the level of the consolidated general budget, it must be financed somehow, that is why the state will contract loans. The loan can be contracted either within the national system (from the population or the private sector) or outside the national system (from other governments, central banks or commercial banks), or from any other sources, such as, for example, from the international capital market, through the issuance of government (sovereign bonds), so-called bonds. Of course,

the loan in question carries interest (and, possibly, bank charges) so it will have to be repaid corrected by a multiplier, which we can call the debt service multiplier. The best situation is that there is no budget deficit, that is, all budget expenditures should be financed (covered) by the tax revenues actually collected from the public budget. However, the budget deficit is not only possible, but seems to be a rule, even worldwide.

For the concept of fiscal consolidation, we used an operational definition: *reducing the public deficit relative to GDP*. Two elements are important in this operational definition: *i) the first element – the public deficit and ii) the second element would be the relative deficit*, in relation to which, some considerations are necessary and useful:

➢the absolute deficit is likely to fall and yet the relative deficit to GDP is likely to increase.

For the demonstration we make some simple formalization:

Let's note:

✓D the absolute value of the BGC deficit (i.e. it is the absolute difference between tax revenues and budget expenditures);$D = V - C$

✓Y gross domestic product (GDP) in absolute terms;

✓d the deficit relative to GDP, i.e. ;$d = \frac{D}{Y}$

✓with , respectively, two moments of time were noted in which empirical (statistical) observations are madeij

We can have the following situation (hypothetical, but relevant from a conceptual and methodological point of view):

$$D_i = V_i - C_i$$

$$D_j = V_j - C_j$$

$$d_i = \frac{D_i}{Y_i}$$

$$d_j = \frac{D_j}{Y_j}$$

✓α the GDP growth index,

✓β Budget deficit growth index

Then we have:

$$D_j = \beta \cdot D_i$$

$$Y_j = \alpha \cdot Y_i$$

So, we can write:

$d_j = \frac{\beta \cdot D_i}{\alpha \cdot Y_i} = \frac{\beta}{\alpha} \cdot d_i$ (3)

Assuming that, which means that the budget deficit, in absolute value, decreases, which means that the GDP, in absolute value, also decreases, but if, under these conditions, it follows that the budget deficit decreases in absolute value but it increases in expression relative to GDP. $\beta < 1 \alpha < 1 \beta > \alpha d_j > d_i$

The question arises: "why would the value of the budget deficit relative to GDP be more relevant than the value of the budget deficit in absolute value?". The relevance in question arises from a number of considerations, of which I attach particular importance to comparability. Comparability (time and space): the use of the relative value to GDP of the consolidated general budget deficit also ensures, from a methodological point of view, the comparability of the values in question between different points in the same fiscal system or comparability between different fiscal systems at the same point in time. A direct comparison of the absolute values of the budget deficit would have no relevance, as shown above.

Further analyzing, a process of fiscal consolidation, at the level of a given fiscal-budgetary system, occurs when the budget deficit registers a decrease between two moments of time. Thus, if we note with the budget deficit recorded at the time and with $d_i ig_i$*the absolute time gap of the budget deficit*, we can write, between two successive moments (between two successive recordings or measurements):

$g_i = d_i - d_{i-1}$ (4)

This absolute coefficient is expressed in percentage points, since the values of the budget deficit are expressed in a number of percentages, i.e.:

$g_i(pp) = d_i(\%) - d_{i-1}(\%)$ (5)

The following distinct (and alternative) situations may arise:

i)absolute tax deconsolidation, when ;$g_i > 0$

ii)absolute fiscal stagnation, when ;$g_i = 0$

iii)absolute fiscal consolidation, when ;$g_i < 0$

From a methodological point of view, we can identify the following cases/situations of the fiscal consolidation process:

➢A *linear* movement of the budget deficit gap: refers to whether any

of the three cases above (deconsolidation, consolidation, stagnation) register a linear trajectory (as, recently, the Romanian Government signed an agreement with the European Commission for fiscal consolidation from the current budget deficit to the benchmark value of the Maastricht Treaty, within a period of seven years. In this case, between any two moments of time (or recording moments), which must be regular, i.e. there must be the same interval between any two moments taken into account, the budget deficit gap has the same numerical value, i.e. the same number of percentage points; From a formal point of view, we have:

$$p_i = p_{i-1}$$

where:

- the slope of the curve joining two successive values of GDB, for , $pi \in [1,2,\dots,n]$

n - the number of measurements made on the interval of interest considered.

Three distinct situations arise within a linear motion:

✓upward linear *motion*: the GDB values increase equally from measurement to measurement, with the size required by the slope (positive, in this case) of the curve in question; the logical condition being:

$$(p_i > 0) \wedge (p_i = p_{i-1}) \wedge (g_i = g_{i-1}) \wedge (g_i > 0)$$

✓decreasing linear *motion*: the GDB values decrease equally from measurement to measurement, with the size required by the slope of the curve in question (negative); formally, the mathematical condition is:

$$(p_i < 0) \wedge (p_i = p_{i-1}) \wedge (g_i = g_{i-1}) \wedge (g_i < 0)$$

✓constant linear *motion*: GDB values are null from measurement to measurement; the slope of the curve is zero, and the logical-mathematical condition is:

$$(p_i = 0) \wedge (g_i = 0)$$

The slope of the line that ensures the linearity of the motion in question can be higher or lower, as the case may be – it is essential that the slope in question be constant over the entire interval on which the measurements are made, since this is the mathematical condition of linearity.

In the above conditions there is a redundancy, logically, but I have kept it, to reinforce the basic idea:

$$(p_i > 0) \leftrightarrow (g_i > 0)$$

$$(p_i < 0) \leftrightarrow (g_i < 0)$$

$$(p_i = 0) \leftrightarrow (g_i = 0)$$

➢a non-linear movement of the budget deficit gap, which is not impossible, although it seems rather unrealistic. Assessments of linear motion can also be made here, mutatis mutandis.

Sustainability of fiscal consolidation: refers to ensuring the conditions, in terms of the size of the consolidation tranche produced at a given time, for the process to penetrate, in terms of the consolidation effect, into the functioning structure of the real economy and the nominal one with which the real economy interacts. The sustainability of fiscal consolidation is a phenomenon that occurs in the medium term (but, as a rule, in the long term) and has a structural nature, which ensures its preservation, which is equivalent, from the point of view of the referential, to sustainability. The question that arises is whether a sustainable process should be considered irreversible? A sustainable process cannot continue sine die, so we cannot say (at least, following this research) that the sustainability of fiscal consolidation – allows reversibility without, eo ipso, losing its very property of sustainability, so the answer to the question is negative.

Logically, we can construct a threshold, a *synergistic threshold for inducing the sustainability of fiscal consolidation* (noted) which is a function – most likely, non-linear – of three thresholds: the temporal threshold (), the dimensional threshold () and the structural threshold () – the index comes from the term mix, referring to the combination of the amount of fiscal stimulus on budget revenues and the amount of fiscal stimulus on budgetary expenditures –, that is, we have the function:$P_S^{CF} P_T^{CF} P_D^{CF} P_M^{CF} M$

$$P_S^{CF} = h(P_T^{CF}, P_D^{CF}, P_M^{CF}) \quad (5)$$

For the convenience of writing, the following notation substitutions are used: $P_S^{CF} \coloneqq y P_T^{CF} \coloneqq x_1 P_D^{CF} \coloneqq x_2 P_M^{CF} \coloneqq x_3$. Then the function h is written:

$$y = h(x_1, x_2, x_3)$$

Consequently, fiscal consolidation is ensured by the simultaneous achievement of those three materiality thresholds. The question arises: are the thresholds of significance ontological thresholds (of an objective nature) or epistemological thresholds (of a subjective nature, of the nature of the project or of the purpose)? In short, the logical analysis of the question reveals:

-*First of all*, it must be said that there are, of course, objective correlations between the fiscal-budgetary variables, on the one hand, and the other economic variables, on the other hand, correlations that occur and have effects independently of the subjectivity of the economic agents or regulatory agents – for example, the tax is strictly the result of multiplying the tax rate by the tax base existing at a given time, no subject can intervene here;

-*Secondly*, on top of these objective correlations (causal, conditional, functional, etc.), the subjective decision intervenes – for example, the tax collected (actually) may differ from the calculated tax (the latter being generated by the objective correlation) if the degree of collection of budgetary obligations is subunitary. Basically, the degree of collection can be unitary only by accident, because there will always be either incapacities of the collection authority (in Romania, ANAF), incapacities aimed at either corruption, or capacities of the taxpayer to hide the tax base or reduce it (tax fraud), etc. There may also be rarer cases in which the collection rate is supraunitary, when outstanding debts are recovered or late payment penalties are added to the tax obligations due. This is obviously a subjective factor;

-*Thirdly,* the economic action (therefore also the fiscal-budgetary one), either at the level of the taxpayer, or at the level of the normative authority or/or of the fiscal administration authority, is an artifact, it is initiated and oriented by goals and objectives, so that the dominant factor in establishing the three thresholds of significance is the subjective factor. Of course, the subjective factor will have to take into account the objective movement of the fiscal-budgetary phenomenology precisely in order not to take decisions or carry out actions that are contradictory to the mentioned objective side.

To be sustainable, fiscal consolidation must be maintained (i.e. not reversible) for a period of time beyond the time threshold PT^{CF}. Although this threshold is also conditioned by objective factors, i.e. acting from the perspective of the fiscal-budgetary process itself, for the most part it is a parameter at the disposal of the fiscal-budgetary normative authority, i.e. having an accentuated character of economic policy.

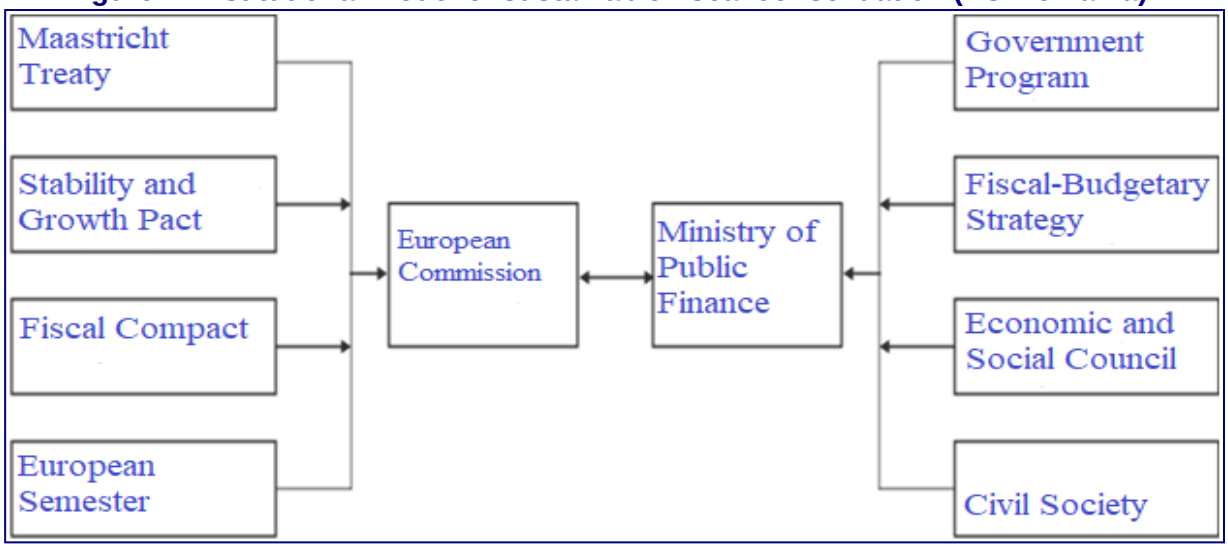
The budget deficit gap must be reduced to the level of the PDCF dimensional threshold, from a sustainability perspective. A gap above this threshold will also pose the risk of reversibility of fiscal consolidation.

Taking into account the last considerations, the answer to the question of a sustainable process must be considered irreversible is nuanced in the sense that the irreversibility of tax processes, in this case of fiscal-budgetary consolidation, is given by the mentioned thresholds.

The above exposition, being a purely theoretical one, must also ensure a praxiological perspective, mainly from that of ensuring resources, of any kind, intended to achieve this goal, which resources must be allocated in the appropriate quantity, order and pace.

Institutional framework: is formalized and presented in figure no. 2

Figure 2: Institutional model of sustainable fiscal consolidation (EU-Romania)



Source: elaborated by the author from unpublished paper of research project of CCFM 2025, coordinator Dutcas.

As the figure reveals, the model targets the generic institutional structures of an economic system that must ensure the design, implementation and control of the impact of fiscal-budgetary decisions that have a consolidating and sustainable effect. The decisions support the ability of the economic system – the national economy – to generate a multiplier, either budgetary, i.e. budgetary expenditures, or fiscal, i.e. tax revenues (or the average tax rate) that does not irreversibly disrupt the functioning of the economic system in question, i.e., in general, keep the economic system in a certain area of stability/sustainability.

Specifically, if we refer to the conditions of the Maastricht Treaty, that structural and functional state of the national economy in which the gap between the annual pace of budgetary expenditures and the annual pace of gross national income does not exceed 3 pp.

The objectives assumed by Romania through the Medium-Term Budgetary-Structural Plan for the sustainability indicators of public finances are presented and analyzed in the following Table:

Table 1: Analysis of the sustainability of Romania's fiscal consolidation objectives

	Indicator	2024	2025	2026	2027	2028	2029	2030	2031
1.	Potential GDP – annual rate (%)	2,7	2,7	2,5	2,4	2,2	2,1	2,0	2,0
2.	GDP deflator – annual rate (%)	7,2	5,0	4,9	4,8	4,7	4,6	4,5	4,4
3.	Net primary expenditure – annual rate (%)		5,1	4,9	4,7	4,3	4,2	3,9	3,8
4.	ESA budget balance (in GDP) %	-7,9	-7,0	-6,4	-5,7	-5,0	-4,2	-3,4	-2,5
5.	Relative structural budget balance (in GDP) %	-7,3	-6,3	-5,7	-5,1	-4,3	-3,5	-2,7	-1,8
6.	Relative structural primary budget balance (in GDP) %	-5,3	-4,3	-3,3	-2,3	-1,3	-0,3	0,7	1,7
7.	Budget deficit target ceiling - pp	3	3	3	3	3	3	3	3
8.	Total Relative Gross Government Debt (in GDP) - %	52,2	55,7	58,5	60,6	62,0	62,6	62,4	61,4
9.	Annual change in total relative gross government debt (in GDP) - pp	3,4	3,5	2,8	2,1	1,4	0,6	-0,2	-1,0
10	Sustainability assessment	-	-	-	+	+	+	+	+

Source: PBSNTM

Analysis of the data in the Table:

-the annual decrease in the potential GDP rate can be explained by the base effect (equal increases in absolute value are found in slight decreases in relative value or, as the case may be, in the stagnation of these relative values);

-the deflator at the level of goods and services in the consumer basket (consumer goods price index, inflation) is not taken into account because fiscal consolidation is the cumulative, integrated and synergistic effect of both demand and supply, both from the perspective of consumption and from the perspective of other components of aggregate demand (e.g. expenditure on public investment, including from European funds), so the GDP deflator is relevant, not inflation;

-as for the public debt, Romania does not aim to reach the ceiling for 2024, the relative budget balance (in GDP). In the 2010 ESA (European System of Accounts) accrual reporting system is, according to EUROSTAT data, -9.3%, but we have kept the value -7.9 in the table, as it was estimated in October 2024 for the entire year 2024. Throughout the analysis we made the calculations based on the ESA 2010 methodology, although there are differences between the values calculated according to the ESA and those calculated according to the cash methodology (in the cash methodology, the expenses actually paid are taken into account, while, in the ESA methodology, the expenses due are also taken into account even if they are not yet paid, which explains how on the cash methodology, the relative budget deficit in 2024 was 8.65%, while, according to the ESA methodology, it was 9.3%).

-the structural primary budget balance becomes positive (i.e. the structural primary consolidated general budget becomes surplus) in the last two years of the fiscal adjustment/consolidation period: 2030 and 2031, respectively; moreover, the consolidation in question is relatively accelerated (in 2031 the positive balance of this budget increases, compared to 2031, by almost 143%);

-public debt at a maximum level of 60% of GDP at the end of the fiscal adjustment/consolidation period, on the contrary, in relative terms, it increases permanently between 2025 and 2029, only starting with 2030 assuming a very slight decrease (by 0.2 pp), so that, in the last year of the period (2031) a decrease of 1 pp is assumed. It should be noted that in the document Romania's Medium-Term Budgetary-Structural Plan there is no structure of the public debt, neither by sources of financing nor by destinations (use), in order to carry out a more detailed analysis.

Results

- Theoretical models and DSA tools provide a useful framework, but do not sufficiently integrate geopolitical risks and strategic priorities;
- EU regulations and comparative experiences underline the importance of institutions and cross-temporal policy coherence;
- The emerging literature highlights the role of armed conflicts and increased defence spending as factors putting pressure on fiscal sustainability;
- In Romania, the main gaps are related to the integration of strategic and institutional dimensions into a coherent conceptual framework to underpin public policy.
- The functioning of the economy (and of the state) during the period of fiscal consolidation,

when the economic growth impulse is slowed down by the trajectory of reducing the budget deficit, needs external resources (monetary injections) – either from the private sector (internal or external) or from the public sector (external).

Conclusions

The results of the research show that a sustainable fiscal-fiscal consolidation is not reduced to the observance of numerical deficit and debt thresholds.

The sustainable nature of the fiscal-budgetary consolidation process implies:

-logical coherence between fiscal rules and the objectives of stability, efficiency and fairness;

-institutional credibility and increased administrative capacity;

-integrating fiscal adjustment strategies into a broader framework of economic development and social resilience.

Fragile fiscal governance undermines fiscal discipline and accentuates procyclicality, while credible, independent institutions well anchored in the European framework can turn consolidation into a gradual, sustainable and development-oriented process.

Future Directions

In the future, the analysis can be extended by: i) integrating structural determinants, such as the green transition, digitalisation and demographic change, into the modelling of fiscal sustainability; ii) applying dynamic models (ECM, DSGE with fiscal constraints) to estimate the long-term effects of rules and institutions on fiscal balance and growth.

Future research can help inform more resilient fiscal policies that align fiscal discipline with sustainable development goals.

Text notes

[1] Econometric methods aimed at identifying the relationship between institutional robustness and fiscal consolidation performance, including tests for procyclical biases and effects on macroeconomic stability, were used in the research, but will not be exposed for reasons of economy of the paper.

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MODELING THE EFFECTS OF SUSTAINABLE DEVELOPMENT ON THE EQUITY RISK PREMIUM

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Abstract:

This paper is a secondary data analysis regarding the relationship between sustainable development and the cost of equity (Equity Risk Premium — ERP) in the European context, with the main objective of providing a panel econometric model with country and time-specific effects for ERP estimation. The study adopts a quantitative methodology, combining panel regression and secondary data analysis of a sample from 28 European countries over the period 2000–2023. The findings reveal a generally negative correlation between the Sustainable Development Index (SDG Index) and ERP. Moreover, it was observed that most individual SDG indicators did not show statistical or economic significance; out of the 17 components of the aggregate SDG Index, only 6 proved to be significant. The study emphasizes that the panel econometric model employed can estimate ERP values with high accuracy, average estimation errors being small. Thus, the choice of long-term bond yields and the aggregate Sustainable Development Index (SDG Index) as independent variables generated significant results, indicating that these variables can be used in models for estimating the cost of equity.

Keywords: *econometric panel model, cost of capital, equity risk premium, sustainable development*

JEL classification: *C23, G32*

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Introduction

The concept of sustainable development occupies a central place in today's economy, aiming to achieve economic growth that meets present needs without compromising the ability of future generations to meet their own. In this context, the relationship between sustainable development and the cost of capital has become a topic of interest for both the academic community and economic professionals. The equity risk premium (ERP) reflects investors perception of the risks associated with investing in a particular economy and serves as a key reference indicator in investment decision-making. Exploring this relationship can provide valuable insights into how progress in sustainable development influences risk perception in financial markets.

The main objective of this research is to establish a panel econometric model to estimate the cost of equity (ERP) for commercial companies. To construct this econometric model, the analysis focused on 28 European countries over the period 2000–2023, examining the evolution of the relationship between the equity risk premium (ERP) and the Sustainable Development Goals Index (SDG Index). In the model all of the European countries during the mentioned period will be included and using a panel econometric model 672 observations are obtained for the final sample.

The specific objectives of the research include: (1) selecting the most appropriate economic variable alongside the Sustainable Development Index and analyzing their relationship, (2) determining and statistically interpreting the coefficients and statistical tests specific to panel econometric models, (3) identifying the best estimation method, whether fixed or random effects, and (4) selecting the most suitable panel econometric model for future ERP estimates by comparing the estimation errors across multiple models.

The paper is organized into three sections: (1) the first section introduces the study context, outlines the addressed issues, and reviews existing literature, highlighting relevant conclusions and identified gaps; (2) the second section presents the research methodology and describes the sample used; (3) the final section includes the statistical analysis of the variables considered in the study and details the panel econometric models employed, as well as the statistical tests conducted to select the most appropriate econometric model.

Literature Review

In the specialized literature, research on the influence of sustainable development indicators on the equity risk premium at the macroeconomic level remains rather limited. Most studies focus on analyzing these indicators at the firm level, without exploring in detail the relationship between a country's sustainable development and the equity risk premium of the national economy. Sustainable development indicators reflect the economic, social, and environmental dynamics of a country and serve as an important tool for assessing long-term economic sustainability and competitiveness.

The study titled "On the Correlation between Market Risk Premiums and SDGs" investigates the relationship between sustainable development indicators (SDGs: Sustainable Development Goals) and market risk premiums (MRPs) at the global level, as well as their effects on firm value. The main objective of the research is to analyze the extent to which initiatives and actions associated with the Sustainable Development Goals can influence the market risk premium and, consequently, the value of firms. The applied methodology is based on a panel regression model used to assess the relationship between the SDG Index score and market risk premiums over the period 2016–2020.

The analysis was conducted on a sample of 790 observations from 158 countries, using three types of market risk premiums: MRP (F), estimated by Fernandez et al. for the period 2016–2021; MRP (CR), calculated by Damodaran based on credit ratings; and MRP (CS), determined by the same author using CDS spreads. To test the formulated hypotheses, the authors applied the Hausman test to determine the appropriate specification between the fixed-effects and random-effects models. In order to correct potential issues of autocorrelation and heteroskedasticity, robust Driscoll-Kraay estimators were employed. Additionally, the model included control variables such as GDP per capita, the Democracy Index, and the ratio of public debt to GDP.

The conclusions of the study highlight the existence of a significant negative correlation between the overall SDG Index score and market risk premiums. The estimated coefficients for the SDG Index Score ranged from -0.036 to -0.121, indicating that a one-point increase in this score leads, on average, to a reduction of approximately 5.5 basis points in the market risk premium. For instance, to achieve a 1% decrease in the MRP, an increase of about 18 points in the SDG score would be required.

The analysis of individual goals revealed significant relationships between certain SDGs and market risk premiums, such as SDG 3 (Good Health and Well-being) and SDG 13 (Climate Action), both were showing a relevant negative correlation. This suggests that improvements in public health and the reduction of climate-related risks contribute to lowering investors' perceived risk.

Conversely, SDG 9 (Industry, Innovation, and Infrastructure) exhibited a positive correlation with MRPs, implying that infrastructure and innovation projects may amplify perceived market risk. For SDG 15 (Life on Land) and SDG 16 (Peace, Justice, and Strong Institutions), no significant relationships were found, indicating the need for further research in these areas.

The results of the study show that sustainable development initiatives can contribute to reducing market risk premiums and increasing firm value, particularly through measures aimed at improving public health and protecting the environment.

The authors suggest that integrating the Sustainable Development Goals (SDGs) into national economic strategies could lower the cost of capital and support sustainable economic growth. However, the research has certain limitations, including the relatively short analysis period of five years (2016–2020), which reduces the ability to capture long-term trends. Additionally, the study was conducted at a global level without examining regional or continental differences, even though risk factors may vary considerably across different areas. Moreover, for some SDGs—such as SDG 1, 2, 4–8, 10–12, 14, and 17—no clear relationship with market risk premiums was identified, indicating the need for further research.In conclusion, the study provides relevant evidence of the link between sustainable development and the reduction of market risk premiums, while emphasizing the importance of extending the analysis period and conducting region-specific investigations in future research (Ito, 2022).

In this context, the present study aims to investigate how macroeconomic indicators of sustainable development influence the equity risk premium at the national level. The research will use statistical data from official international sources such as the World Bank, the IMF, and Eurostat, and will apply advanced econometric techniques to analyze the causal relationships between sustainable development and the equity risk premium. The results obtained will provide insights into how sustainable progress can affect a country financial stability and its attractiveness to investors.

Methodology and Data

Data source and key variables used for the econometric panel model

The research aims, through panel econometric models, to examine how the equity risk premium is influenced by the evolution of sustainable development.

The study analyzes the impact of sustainable development indicators on the equity risk premium (ERP) across Europe during the period 2000–2023, considering the 28 countries included in the analysis.

The SDG Index (Sustainable Development Index) is composed of 17 components, each representing specific aspects of a country and its economy, with each component assigned a specific weight to determine the aggregate index.

The 17 components are described in the table below, and in the analysis, each was individually examined to assess the extent to which it influences the ERP.

Table 1: Description of the variable used and data sources

Name of the variable	Abvreviation	Source	Description
Equity Risk Premium	ERP	Online Damodaran Database https://pages.stern.nyu.edu/~adamodar/	To estimate the equity risk premium (ERP) for a specific country, a methodology is used that starts with the risk premium of a developed market (the U.S.) and adds a country-specific risk supplement. First, the risk premium of the U.S. market is determined, where the ERP is calculated based on the implied risk premium of the S&P 500 index. This reflects the difference between the markets expected return and the risk-free rate, such as long-term government bonds.
Country Risk Premium	CRP	Online Damodaran Database https://pages.stern.nyu.edu/~adamodar/	The Country Risk Premium (CRP) reflects the additional risk of investing in a specific country. It is estimated based on the Credit Default Swap (CDS) spread, which is calculated using a country's Moody's credit ratings.
GDP Growth	GDP%	World Bank- indicator (NY.GDP.MKTP.KD.ZG)	The annual growth rate of GDP at market prices, based on constant local currency. Aggregates are calculated using constant 2015 prices, expressed in U.S. dollars.
Inflation Rate	CPI	World Bank- indicator (FP.CPI.TOTL.ZG)	The annual percentage change in the cost borne by the average consumer for an increase in the price of a basket of goods and services
Risk free rate	Rf	Online Damodaran Database Online- https://pages.stern.nyu.edu/~adamodar/	US 10-year government bond yield
Credit Default Spread	CDS	Online Damodaran Database https://pages.stern.nyu.edu/~adamodar/	The interest rate differential between the yield on U.S. government bonds and the yield on government bonds of the country under analysis.
Long term treasury bond rate	LT_T-Bond Rate	Damodaran database	Own calculations based on CDS and Rf data taken from the Damodaran database
Global Economic Policy Uncertainty Index	GEPU	Davis, Steven J., 2016. "An Index of Global Economic Policy Uncertainty," Macroeconomic Review, October. https://www.policyuncertainty.com/global_monthly.html	The Global Economic Policy Uncertainty Index (GEPU) is an aggregate index that measures economic policy uncertainty at the global level. It is used to assess the impact of uncertainty on economic decisions such as investment, consumption, and financial markets.

			The index provides a quantitative measure of the degree of uncertainty associated with government economic policies worldwide.
Sustainable Development Index	SDG INDEX	Sachs, J.D., Lafortune, G., Fuller, G. (2024). The SDGs and the UN Summit of the Future. Sustainable Development Report 2024. Paris: SDSN, Dublin: Dublin University Press. doi:10.25546/108572	The SDG Index score is presented on a scale from 0 to 100 and can be interpreted as the percentage of progress toward optimal performance in achieving the Sustainable Development Goals (SDGs). Therefore, the difference between 100 and the specific country score in the SDG Index represents the gap, expressed in percentage points, that must be overcome to reach optimal SDG performance. To minimize bias caused by missing data, a general SDG Index score is not calculated, and rankings are not produced for countries that lack data for more than 20% of the indicators. The same set of indicators and similar performance thresholds are used for all countries to generate comparable scores and rankings.
Index SDG 1- No Poverty		SDG 1	
Index SDG 2- Zero Hunger		SDG 2	
Index SDG 3- Good Health and Well-being		SDG 3	
Index SDG 4- Quality Education		SDG 4	
Index SDG 5- Gender Equality		SDG 5	
Index SDG 6- Clean Water and Sanitation		SDG 6	
Index SDG 7- Affordable and Clean Energy		SDG 7	

Source: as indicated in the table

Description of the Research Method

This research adopted a quantitative method, with the main objective of examining the relationship between sustainable development and the cost of capital. The methodology employed involved both statistical and econometric analyses, aiming to identify and interpret the relationships between economic variables and the indicators associated with sustainable development.

Type of research: The study conducted is quantitative in nature, based on the processing and interpretation of numerical data relevant to the analyzed period.

Method used: Panel Econometric Analysis, a panel econometric analysis was applied, with the purpose of capturing the specific characteristics of each country through fixed effects, as well as the dynamics of the relationship between variables during the analyzed period through the period-specific effects.

Data source: The data used in this research were collected from internationally recognized official databases, ensuring the accuracy, reliability, and comparability of the economic information utilized.

Time interval analyzed: The analysis was carried out for the period 2000–2023. This interval was selected because it encompasses several important phases in Europe's recent evolution, while also ensuring that complete data were available for all the countries included in the analysis.

Countries included in the analysis: 28 European countries, as follows: Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Moldova, Poland, Romania, Slovakia, Slovenia.

Database volume: The analysis sample includes 28 countries (cross-sections) over a period of 24 years, with the database totaling 672 observations. This extended sample ensures adequate representativeness and increased relevance of the research results.

This methodological approach, based on econometric analysis using a panel model, allows for an in-depth understanding of the relationship between sustainable development and the cost of capital, specific to each country and time period through the fixed effects inherent to panel models. Thus, each country (cross-section) and period has its own specific term, providing additional and specific empirical support for the interpretation and validation of the obtained results.

The research was carried out in two stages. The first stage consisted in selecting the control variable through a simple regression model between ERP and the control variable, while the second stage involved sequentially introducing into the regression model each of the 17 components of the SDG index, as well as the aggregated SDG index, in order to determine the best panel regression model.

For the panel regression models, tests were conducted to assess whether fixed or random effects were more appropriate, using the Hausman test and the Redundant Fixed Effects test. Additionally, for each regression model, it was verified whether the residuals were correlated across cross-sections using the Pesaran CD test. Each test employed, along with its hypotheses, is explained in the analysis section, together with the interpretation of the corresponding results obtained in EViews.

Research Step 1: Selection of control variables from the list below:

The control variables in econometric analyses are the following: GDP Changes% (annual growth rate of GDP), CPI, (consumer price index), LT_T-Bond Rate (long term bond rate), GEPU (Global economic policy uncertainty index). A panel regression model with fixed effects for country cross-sections and both fixed and random effects for time periods was used, and the control variable was selected based on statistical significance (p-value < 5%) and the highest R^2 of the model.

Research Step 2: Selection of the variable related to the Sustainable Development Index:

After the control variable was chosen and it was determined whether fixed or random effects were more appropriate, each of the 17 components of the SDG index was included one by one in the regression model, along with a separate regression model containing the control variable and the aggregated SDG index. The aim was to determine which specification is more suitable for the final regression model used to estimate the ERP.

For the selection process, the p-values associated with the coefficients and the adjusted R^2 were considered, with preference given to the model that had the highest adjusted R^2 and statistically significant coefficients. In addition, it was verified whether the economic relationship holds true, namely that as the SDG index increases, the ERP decreases.

The final regression model equation will include two independent variables: the control variable capturing the quantitative characteristics of the economy and the variable representing the Sustainable Development Index:

ERP= C + Control Variable + SDG Index Variable + Country Fixed Effects + Period Fixed or Random Effects (depending on validation tests and estimates, in the next section)

Panel Econometric Models for Estimating the Cost of Capital (ERP)

This section aims to investigate the relationship between sustainable development and the cost of equity capital through panel econometric models and by employing the most suitable econometric model as a tool for estimating the risk premium. Econometric analysis represents a crucial stage of the research, with the objective of identifying and quantifying the relationships between sustainable development indicators and the equity risk premium (ERP).

The panel regression model includes two independent variables: a control variable reflecting the quantitative characteristics of the economy and a variable representing the Sustainable Development Index, examining both the aggregated index (SDG Index) and each of its 17 individual components. Throughout this analysis, emphasis will be placed on interpreting the estimated coefficients, testing the statistical significance of the variables, and validating the core regression assumptions through specific econometric tests.

The objective of this section is to address the central research question: to what extent does sustainable development, as measured by the SDG Index, influence the equity risk premium in Europe? The results will be analyzed from the perspective of their economic relevance (the type of relationship, whether positive or negative) and statistical significance, thereby providing a detailed understanding of the mechanisms through which progress in achieving the sustainable development goals is reflected in the cost of equity capital of a national economy.

In the final stage of the analysis, regressions were estimated based on the selected variables, and specific econometric tests were applied to assess the consistency and robustness of the models obtained. This methodological strategy provides a solid foundation for interpreting the results and for drawing conclusions regarding the relationship between sustainable development and the cost of equity capital within European economies.

Analysis of the Explanatory Components: Selection of Relevant Variables for Estimating ER

Panel linear regression econometric models were employed, using both fixed effects and random effects, followed by comparative analysis and validation tests, such as the Redundant Fixed Effects test for validating fixed effects and the Hausman test for validating random effects. The analysis was conducted across European countries, including both Western Europe and Central and Eastern Europe. In total, 28 countries were included in the analysis, with data covering the period 2000–2023, resulting in a total sample of 672 observations (28 countries × 24 years).

In the first stage of the econometric analysis, the statistical significance of the control variables was tested, and the R^2 values were compared to select the best econometric model. Variables that were not statistically significant were excluded. The significance of the control variables was tested by applying a simple regression between the dependent variable ERP and each of the four control variables.

The fixed effects for countries highlight the specific characteristics of each nation, such as consumer culture, infrastructure, level of technological advancement, and other factors that are reflected in investors expected returns. Fixed effects were chosen for the time dimension as well, given that the analyzed period (2000–2023) spans two major crises—the financial crisis of 2009–2010 and the COVID-19 crisis of 2020—both of which directly and simultaneously affected the countries in the sample. The ECB's (European Central Bank)

policies of maintaining low and even negative interest rates after the 2009 crisis also influenced most of the countries in the sample in a similar way. At the same time, estimation was also performed using the random effects method for the period, with results compared accordingly, including the Pesaran CD test for cross-sectional dependence among residuals and the Hausman test for validating random effects.

Subsequently, a regression model with a single explanatory variable from among the control variables was analyzed, to select one variable to be used alongside the SDG Index variable. The panel model was then applied with fixed effects for both countries (cross-section) and period. R^2 and coefficients were analyzed for all four control variables analyzed: GDP Variation, CPI, Long-Term T-Bond Rate (denoted as LT_T_Bond_R), and the GEPU Index. Across the entire sample, the variables showing notable statistical significance are GDP Variation (p-value: 0.0%) and the Long-Term T-Bond Rate. The adjusted R^2 is significantly higher for the LT_T_Bond_R variable (88.8% compared to 73%), which leads us to consider it more suitable for the panel regression model—an observation further confirmed by the Pesaran CD test statistic.

The Pesaran CD test examines whether the residuals are correlated across countries (cross-sections). If residual correlation exists, the estimators are considered inefficient, and the results of other statistical tests may be unreliable. H_0 (Pesaran CD): There is no dependence between residuals across cross-sections, H_1 (Pesaran CD): There is dependence between residuals across cross-sections. The results indicate a p-value of 61.83% > 5%, so the null hypothesis is accepted, and there is no dependence of residuals across cross-sections, confirming the appropriateness of using fixed effects. In conclusion, the control variable to be used in the panel econometric model is the long-term government bond yield, denoted in the model as LT_T_Bond_Rate.

In the next stage, the statistical significance of the aggregated Sustainable Development Index (SDG Index) was tested, along with each of its 17 components individually. The index represents a weighted average of these 17 components, and its relationship with the equity risk premium (ERP) must be negative to be economically meaningful: as the SDG Index increases, the expected returns for investors decrease.

From the total of the 17 variables analyzed, 12 exhibit a negative relationship with ERP, which is consistent from an economic perspective, while 5 show a positive relationship with ERP. Although the p-values for these 5 variables were below 5%, they were not considered because the economic rationale is invalidated. Thus, out of the 17 variables, 6 demonstrate a relationship that is both statistically and economically valid, and the results of the regression models for these variables are presented below.

In both regression models one with SDG1 and the other with SDG4 the adjusted R^2 is high, close to 90%, indicating that the econometric models are well explained by these variables. In both cases, fixed effects were used for cross-sections (countries) and for the time period, and the Pesaran CD statistic was above 5%, indicating that the residuals are not correlated across countries. The “Redundant Fixed Effects” test in EViews has p-value of 0% in both cases, confirming that the fixed effects were correctly applied and are statistically significant.

SDG1 refers to No Poverty. As a country becomes wealthier and more economically developed, the expected ERP values are lower, resulting in a negative relationship. SDG4 refers to Quality Education. As a country achieves a higher level of education, the workforce’s professional skills and innovation improve, enabling the economy to attract better-paid jobs.

In both regression models, for SDG6 and for SDG7 the adjusted R^2 is high, close to 90%, indicating that the econometric models are well explained by these variables. In both cases, fixed effects were applied for cross-sections (countries) and for the period, and the Pesaran CD statistic was above 5%, indicating that the residuals are not correlated across countries. The "Redundant Fixed Effects" test in EViews has p-value of 0% in both cases, confirming that the fixed effects were correctly applied and are statistically significant.

SDG6 refers to Clean Water and Sanitation. As a country provides access to clean water and sanitation, it indicates that the population has modern facilities and infrastructure. This index is highly correlated with SDG1 – No Poverty, sharing methodological overlaps in its calculation. SDG7 refers to Affordable and Clean Energy. This is one of the most important components because energy is a key pillar for industry. The index reflects not only the natural energy resources available in a country but also how efficiently they are managed. For example, some European countries, including our own, have abundant energy resources, yet energy prices in some cases are higher than in countries with fewer natural resources.

SDG8 refers to Decent Work and Economic Growth, SDG10 refers to Reduced Inequalities, in an economy as inequalities are reduced and consumption is more sustained, because there are more people who can buy durable goods and not just subsistence goods.

In both regression models, the one with SDG8 and the one with SDG10, the adjusted R^2 is high, close to 90%, indicating that the econometric models are well explained by these variables. In both cases, fixed effects were used for cross-sections (countries) and for periods, and the "Pesaran CD" statistic was above 5%, showing that the residuals are not correlated across countries. The EViews "Redundant Fixed Effects" test values were 0% in both cases, indicating that the fixed effects were correctly used and are significant.

Validation of the Panel Econometric Model and Selection of the Optimal Effects Structure

In this section was developed a multiple panel regression model, where the dependent variable Y is ERP and the independent variables are LT_T_Bond_R (control variable) and SDG_Index (the aggregated Sustainable Development Index). Two regression models were examined: one with fixed effects for cross-sections (countries) and random effects for time periods, and another with fixed effects for both cross-sections and time periods.

Fixed effects for cross-sections (countries) are validated by the specific economic and social characteristics of each country. These effects of the panel model add a term similar to the intercept C, but customized for each country. Fixed effects for time periods are justified by the shared events experienced by all European countries and the decisions taken by the ECB (European Central Bank), which directly and similarly affected most countries.

We will use two econometric models: one with random effects for time periods and one with fixed effects for time periods and compare their statistical tests and estimation errors to select the most suitable model. The results indicate that both independent variables are statistically significant, with p-values < 5%, and the intercept (c) is also statistically significant. The regression model has an F-statistic of 149 and an associated p-value of 5%, indicating statistical significance. The regression equation for model with random effects for period is as follows:

ERP= 0.13777 + 1.00322*LT_T_BOND_R - 0.141204*SDG_INDEX + [CX=F, PER=R]

CX = specific fixed effect for country (the cross-section), PER = random effect of the period

The relationship between ERP and LT_T_BOND_R is positive; that is, for a one-unit increase in LT_T_BOND_R, ERP is expected to increase by 1.00322, which is economically consistent. The relationship between ERP and SDG_INDEX is negative; that is, for a one-unit increase in SDG_INDEX, ERP is expected to decrease by 0.141204787151, which is also economically consistent. This makes sense because in developed countries with a high SDG_Index, the cost of equity is lower due to high competitiveness and a mature market.

Subsequently, regression validation tests were performed, including the Hausman test for validating random effects, the Redundant Fixed Effects test, and the Residual Cross-Section Dependence Test to check for residual dependence across sections.

The adequacy of fixed effects was tested in EViews using the “Redundant Fixed Effects” test, and the associated p-value is < 5%, null hypothesis was rejected, which assumes that the fixed effects are redundant, the fixed effects are significant in our case and should be used for the cross-sections (the countries in the model). The Hausman test for the adequacy of random effects was performed, and the p-value for the Hausman test is < 5%, null hypothesis was rejected, meaning that random effects are not suitable for this econometric model. The test for cross-sectional dependence in the residuals was also conducted, and the p-value for the Pesaran CD test is < 5%, null hypothesis was rejected, indicating that there is cross-sectional dependence in the residuals. Therefore, the econometric model with random effects for the period is not appropriate and must be re-estimated by introducing fixed effects.

Thus, although an adjusted R^2 of 86.5% was obtained and the coefficients are statistically significant, the tests for random effects indicate that they are not suitable for the model and may distort the results. Consequently, we will present the results of the model with fixed effects for the time period. The results suggest that both independent variables are statistically significant, with p-values < 5%, and the intercept (c) is also statistically significant. The regression model has an F-statistic of 101 and an associated p-value of 5%, indicating statistical significance. The regression equation for model with fixed effects for period is as follows:

ERP = 0.23585 + 1.05203*LT_T_BOND_R -0.27145*SDG_INDEX + [CX=F, PER=F]

CX = specific fixed effect for country (the cross-section), PER = specific fixed effect for period

The relationship between ERP and LT_T_BOND_R is positive; that is, a one-unit increase in LT_T_BOND_R is expected to result in an increase in ERP of 1.05203, which is economically consistent. The relationship between ERP and SDG_INDEX is negative; that is, a one-unit increase in SDG_INDEX is expected to result in a decrease in ERP of 0.27145, which is also economically consistent. This aligns with the fact that in developed countries with a high SDG_Index, the cost of equity is lower due to high competitiveness and a mature market.

The test for the adequacy of fixed effects was performed, and the p-value for the Redundant Fixed Effects test is < 5%, null hypothesis was rejected, which assumes that the fixed effects are redundant. In our case, the fixed effects are significant and should be used for the cross-sections (the countries in the model). The Pesaran CD test for correlation between the residuals corresponding to the countries (cross-sections) was also performed, and the p-value for the Pesaran CD test is > 5%, null hypothesis was accepted, meaning there is no correlation between the residuals of the countries (cross-sections), the fixed effects are appropriate in our case.

Thus, based on the analyses, the model with fixed effects for both cross-sections and time periods is superior to the one with random effects. This is evident from the adjusted R^2 (88.7% compared to 86.5%) and, more importantly, from the Pesaran CD test value, which indicates that there is no dependence between residuals across countries.

It was observed that the fixed effects vary from country to country, being both negative and positive. Countries with more developed economies, such as Austria, Germany, France, and Spain, exhibit positive country fixed effects, whereas less developed countries predominantly show negative effects. Regarding the analysis period, the panel model effect is negative up to 2009 and becomes positive thereafter. This is because bond yields in Europe were high before the global financial crisis of 2009 and then decreased significantly to stimulate economic growth. Thus, in future research, additional variables may be needed to capture periods of economic shocks, such as the European sovereign debt crisis, the financial crisis, and other economic disruptions, by marking those specific periods in order to provide even more accurate results.

Conclusions

The research results demonstrate the existence of a relationship between sustainable development and the equity risk premium (ERP) in Europe, although this relationship is not uniform or consistent across all the indicators analyzed. Statistical analysis using the panel model revealed a negative correlation between the Sustainable Development Index (SDG Index) and ERP across the entire sample. Thus, as economies develop, the SDG Index increases and investors expected returns are lower, reflecting higher competitiveness and, consequently, lower expected ERP values. At the same time, it was found that most individual SDG indicators were not statistically significant, suggesting that the impact of sustainable development on the cost of capital cannot be directly and independently attributed to each individual goal.

The research aimed to provide users with a tool for estimating the cost of equity capital (ERP) through a panel econometric model, and the results were satisfactory, with small estimation errors. The relationship between ERP and long-term bond yields is positive and strong, representing the most important variable in the model, while the inclusion of the SDG Index improved the overall results.

The average estimation error was small, panel model provided robust results. Developed countries were estimated most accurately, as they exhibited a more stable ERP evolution. The inclusion of fixed effects in the panel model proved effective and helped achieve better estimates, with each country reflecting particularities of economic characteristics and investors expected returns. As such, based on the 28 European countries from 2000-2023, the ERP can be estimated through a panel econometric model using SDG index and long term bond rates as independent variables.

An important limitation of the research is the inclusion of periods encompassing the financial crisis and the sovereign debt crisis, which had significant impacts on long-term interest rates and ERP. Although the results clearly show an influence of the SDG Index on ERP, the econometric methods employed are difficult for practitioners to apply in practice. There is a need for the development of a simpler model that directly reflects the way in which sustainable development affects the cost of capital of a country. Future research could use quarterly or semiannual data and incorporate additional variables to isolate the effects of these crises on the model coefficients. Additionally, applying separate econometric models

for developing countries and developed economies could represent an important direction for future research.

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FISCAL CONSOLIDATION IN TIMES OF UNCERTAINTY: BETWEEN SUSTAINABILITY AND SOCIAL EQUITY

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Abstract:

In the history of contemporary economies, increasingly frequent crises and rapid technological transitions have favored the emergence of periods of uncertainty that have required conjunctural adaptations and strategic reconfigurations, often directly targeting fiscal-budgetary policy, respectively the fiscal consolidation process. In this context, the paper aims to analyze the issue of fiscal-budgetary consolidation in periods in which economic and social uncertainty are prominent, with an emphasis on maintaining a certain balance between budgetary sustainability and social equity. A complex approach is proposed to overcome the exclusively numerical vision, percentages, and aims to integrate economic and social dimensions. It also aims to capture national experiences (Greece, Romania, Germany, Portugal, Hungary and Bulgaria) and integrate the main theoretical paradigms (Keynesianism, neoliberalism, social justice). The results lead to the conclusion that the efficiency of consolidation depends on the state's capacity to ensure the balance between fiscal discipline and social equity.

Keywords: fiscal consolidation, sustainability, social equity, uncertainty, public policies

JEL classification: *H12, H50, H60, H62*

Introduction

Concerns about fiscal consolidation have increased significantly in recent decades, and this is a frequently discussed topic also due to its conceptual diversity. The persistence and size of budget deficits, the volatility and uncertainty regarding their evolution, represent, beyond budgetary accounting, issues of concern for economic stability and social cohesion in many societies. The increasingly frequent and diverse crises, from the global financial crisis of 2008–2010, to the health crisis generated by the COVID-19 pandemic, to the energy crisis, the inflationary crisis and even the geopolitical one, have forced states to take rapid, sometimes contradictory decisions, in order to support and ensure a certain balance between economic stability and the increased social needs of the population.In this situation, fiscal consolidation becomes increasingly important and new values are attributed to it, namely from the stage of a technical instrument for adjusting the budget deficit and stabilizing public debt, it is seen as a much more complex process, with social and even political implications

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through which states seek to maintain a balance between the medium and long-term economic and fiscal perspective and the present social responsibility. These two simultaneous objectives sometimes create structural difficulties, in the sense that a possible fiscal-budgetary measure implemented to ensure economic stability may be perceived as socially unfair and vice versa.

Thus, concerns and analyses regarding fiscal consolidation go beyond the traditional technical approach to budget deficit and public debt, and additionally reflect the way in which the burden of fiscal adjustments is distributed, the legitimacy of institutions, and the social contract between the state and citizens. Relatively recent experiences suggest that a fiscal consolidation implemented quickly and rigidly, without taking into account the social context, can generate instability and social movements, while a fiscal consolidation implemented late can affect confidence in the Government and in financial markets.

Thus, concerns and analyses regarding fiscal consolidation go beyond the traditional technical approach to budget deficit and public debt, and additionally reflect the way in which the burden of fiscal adjustments is distributed, the legitimacy of institutions, and the social contract between the state and citizens. Relatively recent experiences suggest that a fiscal consolidation implemented quickly and rigidly, without taking into account the social context, can generate instability and social movements, while a fiscal consolidation implemented late can affect confidence in the Government and in financial markets.Based on these findings and challenges, the purpose of this paper is to carry out an integrated analysis of the fiscal consolidation process in times of uncertainty, with a focus on tracking the effectiveness of the two simultaneous objectives: fiscal sustainability and social equity. From a methodological point of view, the analysis aims, on the one hand, to create a broader conceptual framework regarding fiscal-budgetary consolidation and, on the other hand, to evaluate the experiences of some states faced with recent crises in order to identify possible ways in which fiscal consolidation, as an adaptive process, can become effective in the two directions mentioned.

Description of the problem and Literature Review

The increased concern for fiscal consolidation has led to the emergence of a generous interdisciplinary literature in this thematic area, from economic, political, to sociological approaches, in which sense we will attempt a structured approach to the main directions identified.

One of the main ideas that emerge from economic theory and literature is that the process of fiscal consolidation has different effects depending on the economic context – in recession, austerity deepens the crisis, and in expansion it can be less costly. Among the promoters of this idea are: Keynes (1936), who substantiated the idea that in periods of recession, reducing public spending worsens the crisis. From this perspective, procyclical fiscal consolidation is considered counterproductive; Blanchard & Perotti (2002) who analyzed the impact of fiscal shocks on GDP, showing that spending cuts have more pronounced recessionary effects than tax increases; Wyplosz (2012) drew attention to the paradox of fiscal consolidation, namely that too much fiscal discipline in a crisis can even undermine long-term sustainability.

Another strong idea is that fiscal sustainability cannot be reduced to numbers, but requires institutional trust and political legitimacy. Its supporters include, among others: Musgrave (1959) who shows that fiscal sustainability cannot be understood only through budgetary accounting balances, but requires a legitimate social contract between the state and taxpayers; North (1990) demonstrates that economic performance and fiscal stability

fundamentally depend on the quality of institutions: the state must inspire credibility and predictability; Stiglitz (2012) states that unfair fiscal policies destroy the legitimacy of the state, affecting its ability to maintain budgetary balance; Blanchard & Pisani-Ferry (2023), explicitly states that currently fiscal sustainability is a political and institutional construct, not just a debt/GDP ratio.

Another idea is that social equity is essential, and fiscal consolidations perceived as unfair are difficult to implement and can generate instability. This is supported by Rawls (1971), who formulated the difference principle by which he considers that policies are just if they benefit the most disadvantaged, and by Sen (1999), who emphasized that development and public policies should be evaluated in terms of the freedoms and capabilities of individuals, not just macroeconomic aggregates.

Recent crises have also contributed to the development of specialized literature, emphasizing the nuances of flexibility and adaptability of fiscal consolidation strategies, in the sense of their ability to gradually orient towards both objectives - medium and long-term fiscal sustainability and ensuring social equity in the short term.In agreement with this idea, OECD (2015) shows that inequalities reduce the potential for economic growth, recommending fiscal consolidation with adequate social protection; IMF (2013) recognized the negative effects of excessive austerity and advocated for gradual consolidation, with measures to protect vulnerable groups; Gaspar, Mauro & Pattillo (2020, IMF) emphasized that, in the context of the COVID-19 pandemic, the immediate objective was social protection and economic support, and fiscal consolidation should be postponed, but not ignored; European Fiscal Board (2021) advocated for more flexible European fiscal rules, allowing for green and digital investments in parallel with budgetary discipline. And Bruegel (2022) recommended integrating the concept of “social sustainability” into fiscal policies, to avoid polarization and erosion of the social contract.

Methodology

The analysis of fiscal consolidation in times of uncertainty requires an interdisciplinary and mixed methodological approach, since the topic investigated cannot be reduced exclusively to the purely mathematical or strictly macroeconomic dimension. Thus, in an integrative manner, the methodology proposes a conceptual-theoretical approach, for anchoring in established theories, and a comparative-applied one, for evaluating practices and results in different national contexts. This method allows for the description of the phenomenon and its interpretation in relation to the pursued objective, the identification of the conditions under which fiscal consolidation can be both sustainable and equitable.

Problem Statement and Analysis

Conceptual and theoretical analysis

Fiscal consolidation is a multidimensional concept, located at the intersection of economics, politics and social philosophy, its interpretations differing depending on the theoretical paradigm used, and understanding this diversity of perspectives is essential for formulating balanced policies. In this approach, the first stage of the analysis consists of conceptual clarification and substantiation, in which the main theoretical paradigms relevant to the topic of fiscal consolidation were examined, namely Keynesianism, with an emphasis on the role of countercyclical policies, neoliberalism, which focuses on budgetary discipline and the role

of markets, and social contract theory through which equity and protection of vulnerable categories are assessed.

Keynesianism, whose foundations were laid by the famous paperThe General Theory of Employment, Interest and Money (1936), opines between fiscal incentives and the avoidance of pro-cyclical austerity, supporting active public intervention in periods of recession. Thus, from this perspective, Keynes proposes an anti-cyclical vision, namely that deficits are justified in periods of recession, and fiscal consolidation must be carried out in phases of economic growth, when the state can accumulate budget surpluses. From this approach, we note that the process of fiscal consolidation is not an end in itself, but a tool that must be used depending on the position of the economic cycle. In times of uncertainty, the rigid application of fiscal consolidation risks accentuating instability instead of balancing it.

On the other hand, the neoliberal current, based on the ideas of well-known economists (Hayek, Friedman, Buchanan, Nozick), supports a diametrically opposite approach, namely fiscal consolidation is seen as a permanent imperative, regardless of the phase of the economic cycle. Budget deficits are considered harmful in themselves, because they reduce investor confidence, distort markets, generate inflation and unsustainable debts. In this neoliberal perspective, fiscal discipline is seen as the foundation of economic growth, meaning that the state must limit its role to ensuring the framework for the functioning of markets, and the adjustment of imbalances is done by reducing spending and easing the fiscal burden on the private sector.

In the context of our objective, this neoliberal vision may sacrifice social equity in favor of sustainability by reducing investments in education, health and social protection. Even so, the neoliberal vision has massively influenced fiscal consolidation policies in recent decades, especially in the EU, where the rules of the fiscal-budgetary framework are strict (Maastricht criteria, Stability and Growth Pact) and reflect this disciplinary spirit.

From the perspective of social justice, of the social contract, a less economic one, but very important in the efficient implementation of a fiscal consolidation process, a direction is given by the paperA Theory of Justice (1971), by John Rawls, in which the difference principle was formulated, namely the fact that inequalities can be tolerated only if they benefit the most disadvantaged. Brought to the fiscal realm, this implies that consolidation measures must be fair and protect vulnerable categories.

Thus, the adjustment cannot be distributed uniformly, but proportionally to the support capacity of each social class.In the same perspective of social justice, Sen (1999, Development as Freedom) complemented Rawls's vision, emphasizing capabilities and freedoms and argued that the success of a consolidation policy is not measured only in reduced deficits, but also in the way it preserves access to education, health and economic opportunities. From this perspective of social justice, we note that he brings and introduces into the debate on fiscal consolidation the concept of social legitimacy, which argues that a fiscal adjustment is considered sustainable only if it is perceived as fair.

Synthesizing the results of the conceptual analysis through the lens of the three paradigms, we note that they offer different visions on the interpretation of fiscal consolidation, namely Keynesianism emphasizes the importance of the moment of consolidation, neoliberalism emphasizes discipline and the role of markets, and social contract theory focuses on justice and equity. Moving on to the practice and reality of fiscal consolidation processes, we note that fiscal-budgetary policies combine elements from all these paradigms. Fiscal consolidation can be sustainable and equitable only through a balanced mix, starting from budgetary discipline, paying attention to the economic cycle and simultaneously pursuing the protection of vulnerable categories.

Comparative analysis

The comparative analysis of the fiscal consolidation strategies applied by some EU states (Greece, Romania, Germany, Portugal, Hungary, Bulgaria), in recent decades, reveals significant differences in terms of the instruments used, the socio-economic context and the results recorded.

After the global financial crisis, ***Greece*** became an example of harsh austerity imposed under pressure from international creditors. Between 2010 and 2015, fiscal consolidation measures included drastic cuts in wages and pensions, tax increases, and accelerated structural reforms. Although these policies reduced the budget deficit and put the country back on a balanced budget path, the social costs were huge: unemployment of over 25%, massive emigration, increased poverty, and a deep crisis of trust in institutions. The legitimacy of these measures has been constantly challenged, showing that the fiscal sustainability achieved through extreme austerity is fragile and unsustainable in the long term.

Romania went through an episode of severe fiscal consolidation in 2010, in the context of the economic crisis and pressure from the International Monetary Fund. The central measure – cutting public sector salaries by 25% – managed to reduce the budget deficit in the short term, but had significant negative effects on the middle class and on trust in the state. Unlike Greece, Romania did not experience a generalized economic collapse, but the adjustment was perceived as unfair and left deep traces in the relationship between citizens and institutions. Currently, Romania is again facing a situation of fiscal consolidation, and the measures already approved and implemented seem to be oriented exclusively towards fiscal sustainability, and less towards social equity.

Germany is a unique case, as it has managed to combine fiscal discipline with social protection. The "*zero deficit*" principle has been rigorously applied, but without sacrificing essential public investment or weakening social protection. This approach has allowed it to maintain market confidence, ensure fiscal sustainability and protect social cohesion. However, critics have argued that excessive discipline has limited long-term investment potential, especially in infrastructure and the green transition.

Portugal, like Greece, underwent a severe fiscal adjustment program under the supervision of European and international institutions. However, unlike Greece, it managed to combine austerity measures with supportive social policies, notably through the partial protection of public services and through social dialogue. The result was a faster recovery of public confidence and a more robust economic recovery, although public debt still remains high.

Hungary adopted a more atypical fiscal consolidation strategy after the financial crisis, combining austerity measures with policies of partial nationalization of strategic sectors and special taxes on certain industries. Although these measures temporarily reduced the deficit, they generated tensions with foreign investors and European institutions. Hungary illustrates a "heterodox" consolidation model, which relied on centralization and political control, but which raises questions about its long-term sustainability.

Bulgaria is among the few European countries that have maintained consistent fiscal discipline, avoiding excessive deficits. However, this strategy has come at a social cost in the form of reduced levels of public spending on education, health and social protection. Bulgaria shows that fiscal sustainability achieved through permanent austerity can be compatible with financial stability, but at the expense of social equity and the quality of public services.

From the comparative analysis of the situations of the countries presented, several typologies emerge regarding the approach to the fiscal-budgetary consolidation process, namely:

- hard austerity model (Greece, Romania) managed to reduce deficits, but generated major social costs and an erosion of state legitimacy;
- balanced model (Germany, Portugal) combined fiscal discipline with social protection, managing to maintain social cohesion and external credibility;
- heterodox model (Hungary) or permanent austerity (Bulgaria) shows that there are alternatives, but each has its own vulnerabilities.

It is noted that the process of fiscal-budgetary consolidation is not a uniform one, but a deeply contextualized one, dependent on internal factors (administrative capacity, economic structure, political culture) and external (EU integration, role in global financial markets).

From the perspective of the objective of the paper, the results of the comparative analysis bring important nuances regarding the way in which different states have succeeded or not in harmonizing the two objectives of fiscal-budgetary consolidation: fiscal sustainability with social equity.

Countries such as Greece and Romania demonstrate that rapid and severe adjustments, based predominantly on reducing expenditures and increasing tax rates, can temporarily solve the problems of the budget deficit, but generate significant negative consequences: in Greece structural unemployment, poverty, exodus of qualified labor and a crisis of political legitimacy, and in Romania: the erosion of the middle class, the decrease in domestic consumption and the loss of trust in institutions.

Another, more favorable context emerges from the analysis of the cases of Germany and Portugal, which shows that the success of fiscal consolidation does not consist only of spending cuts or tax increases, but also of structural reforms oriented towards modernization and efficiency. Germany applied fiscal discipline simultaneously with investments in competitiveness and social protection, and Portugal compensated for budgetary constraints through social dialogue and the protection of certain public services. The experience of these two countries also demonstrates that smart reforms, consisting of the digitalization of the administration, the fight against tax evasion, the prioritization of investments with a multiplier effect, are essential to give a sustainable character to fiscal consolidation.

The experiences of Hungary and Bulgaria demonstrate that there are alternative models for approaching the fiscal-budgetary consolidation process, namely: Hungary, through a "heterodox" consolidation, resorted to special taxes and political control over some economic sectors, achieving temporary results, but with reputational costs and tensions with international institutions, and Bulgaria, through permanent fiscal discipline, maintained low deficits and low debts, but at the cost of chronic underfinancing of public services and deepening inequalities. These situations show that neither permanent austerity nor unorthodox solutions can constitute good models of sustainable consolidation.

A common element of all the experiences analyzed is the role of social acceptability, of the perception of social and fiscal fairness. Measures that were perceived as unfair were met with protests and opposition (Greece, Romania, Hungary), which reduced the political sustainability of the consolidation. In contrast, where governments managed to maintain the functionality of the social contract, through consultation, transparency, social protection and a more equitable distribution of the fiscal burden, the measures were better tolerated (Germany, Portugal).

Summarizing the results of the comparative analysis through the lens of the 6 countries analyzed and the findings retained, we note that the nature of fiscal consolidation and its effectiveness is dependent on the state's capacity to combine budgetary discipline with structural reforms and to maintain social legitimacy.

Conclusions

By exploring the fiscal-budgetary consolidation process, from conceptual-theoretical and practical perspectives, with the stated objective of achieving an integrated analysis of this process in times of uncertainty, with an emphasis on pursuing the simultaneous satisfaction of the two objectives - fiscal sustainability and social equity - it has been demonstrated that the fiscal consolidation process, especially in times of uncertainty, is not a simple exercise in adjusting the budget deficit, but rather it represents a multidimensional process viewed as a technical mechanism for reducing the deficit and public debt, by classical theories, and historical and contemporary practical experiences demonstrate that this must be viewed as a permanent negotiation between sustainability and equity. Fiscal-budgetary consolidation represents, in essence, an art of balance between the discipline of numbers and social solidarity, between responsibility for the future and the needs of the present.

For Romania, but also for states with a similar profile (Hungary, Bulgaria), the analysis suggests that future fiscal consolidation policies must avoid the trap of abrupt austerity and the following must be emphasized: broadening the tax base, reducing evasion, protecting fundamental public services (education, health, infrastructure), building a credible social contract, in which citizens perceive consolidation as a collective and fair effort, not as a unilateral burden.

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THE CAPITAL OF THE HOUSEHOLDS AND WAYS OF TAXING IT. A THEORETICAL ANALYSIS AT THE LEVEL OF EUROPEAN UNION COUNTRIES

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Abstract:

The taxation of capital is a widely debated topic in specialized literature, the main themes starting from the complex nature of capital to different evaluations of inequality, the theoretical validity of optimal fiscal results and how to approach the restrictions imposed by capital mobility, as well as the specifics of the countries analyzed. In this paper we propose to carry out a theoretical analysis of the tax treatment of household capital income among the EU member states (we refer to income from specific assets, capital gains, inheritances and donations/gifts), in this sense using mainly a descriptive methodology, by appealing to various bibliographic sources, mainly from foreign literature as well as the use of official documents of the fiscal entities of the respective countries.

Keywords: *tax, household capital, income from specific assets, capital gains, inheritances and donations/gifts*

JEL Classification: *H24, H31*

Introduction

There are multiple ways in which taxes can be used to collect more from the wealthy, namely direct taxation of the stock of net wealth, which can be done regularly through a wealth tax, occasionally through a one-time capital tax or when wealth is transferred through donation, inheritance and gift taxes, or by taxing the income stream from wealth, i.e. capital income, some of it coming in the form of capital gains.

Capital taxation, including taxation of capital income and stocks, could play an important role in increasing revenue efficiency and making the tax system fairer. Recent international tax developments in terms of automatic exchange of information and administrative cooperation have increased the ability of Member States to levy taxes on mobile tax bases such as capital income.

Capital taxes include taxes on capital income from corporations, households and the self-employed, as well as taxes on capital stocks (recurrent property taxes, inheritance taxes) or on transactions in capital. Specifically, household capital means the capital stock and capital

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income. Capital stock refers to ownership taxation and ownership transfer taxation, and capital income refers to the taxation of income from holding capital (income from rents, financial assets or private pension funds) and the taxation of income from the transfer of capital ownership (capital gains).

In the paper, we develop a theoretical approach to the revenues from the taxation of household capital, namely the revenues from the taxation of immovable property (in this sense, we use the user cost of housing (UCOH) indicator, analyzed by the European Commission, statistical data coming from the House taxation database, for the year 2022), the revenues from the taxation of capital gains and those coming from the taxation of wealth transfers - inheritance and donations. The methodology used is descriptive and empirical, by using bibliographical references from international specialized literature, as well as statistical data for the member states of the European Union, for the years 2022/2023 (depending on the availability of data) provided by the European Commission (Data on Taxation Trends, Housing Taxation Database 1995-2022 v5.0), OECD, PriceWaterHouse(PwC) or the Erst&Young(E&Y) report.

Literature review

Economic theory suggests that taxation has an important effect on household investment choices and portfolio composition (Domar and Musgrave, 1944; Mirrlees, 1971; Feldstein, 1976), an effect that can be realized through different effective (marginal) tax rates within households and across assets, which can lead to portfolio specialization.

The literature on EU countries covers tax reforms affecting different types of assets, such as real estate, financial assets or private pensions. For real estate, the literature shows that transaction taxes can lead to a shift from housing investment to higher-return commercial investment. However, they can also discourage the process of housing commercialization and, in turn, the reallocation of housing to its most productive use. Based on administrative data, Best (2017) found that the temporary removal of a 1% transaction tax increased housing market activity by 20% in the short term in the United Kingdom. The favourable tax treatment that is often given to owner-occupied housing – imputed rent is non-taxable and mortgage interest is tax deductible – represents a tax expense that can lead to severe economic distortions, both in the choice of 'right of occupancy' and the allocation of capital to different types of property, as well as in the accumulation of property debt. Transaction taxes and tax subsidies for home ownership affect economic efficiency more broadly by increasing the costs of geographic relocation of workers.

For investment in financial assets, Alan and Leth-Petersen (2006) examined the effects of a substantial tax reform in Denmark on the composition of household portfolios. The reform reduced the marginal tax rate on capital (bonds and shares), while increasing the cost of debt. The study finds that the tax reform significantly incentivizes households to restructure their balance sheets in favor of capital. Zoutman (2015) studied the effects of a capital income tax reform in the Netherlands, which increased the tax on financial assets as well as on owner-occupied housing. The study shows that the tax reform had a significant impact on the share of the portfolio invested in financial assets. As for investment in private pensions, Jappelli and Pistaferri (2003) examined, for Italian life insurance contracts, the impact of removing tax incentives for people with high marginal tax rates and introducing incentives for those with low rates. The study concludes that the reform had no effect on either the decision to invest in life insurance or the amount invested. A possible explanation is the lack of information and the lack of commitment to long-term investments.

The OECD analysis (2018) found that effective marginal tax rates are often higher than the statutory marginal rates applicable to household capital income. This is mainly due to heterogeneous tax treatment, the presence of multiple taxes on capital income (e.g. income taxes, capital gains taxes, transaction taxes, etc.), tax deferral effects and the specific tax treatment of specific assets that reduce the tax base (e.g. tax expenditures).
According to the theory of optimal taxation, in the absence of market failures, a tax system should be neutral with respect to when to save and consume (Mirrlees, 1971; Conesa et al., 2009). To maintain a stable level of consumption over their life cycle, individuals invest a portion of their income in order to benefit from a return in the future. The timing of the investment will depend largely on the individual's personal situation and characteristics, as well as their intertemporal consumption choices over their lifetime and a tax system should not distort these decisions.

Taxation of household capital income

The taxation of household capital income has an impact on households' disposable income (especially during periods of unemployment or retirement), on households' investment decisions, i.e. on households' decisions on how much and when to invest and in which assets to invest. The tax treatment of household capital income differs considerably from one country to another (see Table 1).

Table 1: Tax treatment of different types of assets in EU countries

	dual/mix taxation	Owner-occupied housing	rental income	Financial income		Private pension income
				interests	dividends	
BE	Mix	untaxed	PIT	Separately	Separately	Separately
BG	Mix	untaxed	PIT	Separately	Separately	Separately
CZ	Mix	untaxed	PIT	Separately	Separately	Separately
DK	Mix	untaxed	PIT	PIT	PIT	PIT
DE	Mix	untaxed	PIT	Separately	Separately	PIT
EE	Mix	untaxed	Separately	PIT	PIT	Separately
IE	Mix	untaxed	PIT	Separately	PIT	PIT
EL	Mix	untaxed	Separately	Separately	Separately	PIT
ES	Mix	untaxed	PIT	Separately	Separately	Mix
FR	Mix	untaxed	PIT	PIT	PIT	PIT
HR	Mix	untaxed	Separately	Separately	Separately	Separately
IT	Mix	untaxed	Mix	Separately	Separately	Separately
CY	Mix	untaxed	PIT	Separately	Separately	PIT
LV	Mix	untaxed	Mix	PIT	PIT	PIT
LT	Mix	untaxed	Mix	Separately	Separately	PIT
LU	Mix	untaxed	PIT	Separately	Separately	PIT
HU	Mix	untaxed	Separately	Separately	Separately	Separately
MT	Mix	untaxed	Mix	Separately	Separately	PIT
NL	Mix	PIT	Separately	Separately	Separately	PIT
AT	Mix	untaxed	PIT	Separately	Separately	PIT
PL	Mix	untaxed	Mix	Separately	Separately	PIT
PT	Mix	untaxed	PIT	Separately	Separately	PIT
RO	Mix	untaxed	Separately	Separately	Separately	Separately
SI	Mix	untaxed	Separately	Separately	Separately	PIT
SK	Mix	untaxed	PIT	Separately	Separately	Separately
FI	Dual	untaxed	Separately	Separately	Separately	Separately
SE	Dual	untaxed	Separately	Separately	Separately	PIT

note: PIT- personal income tax

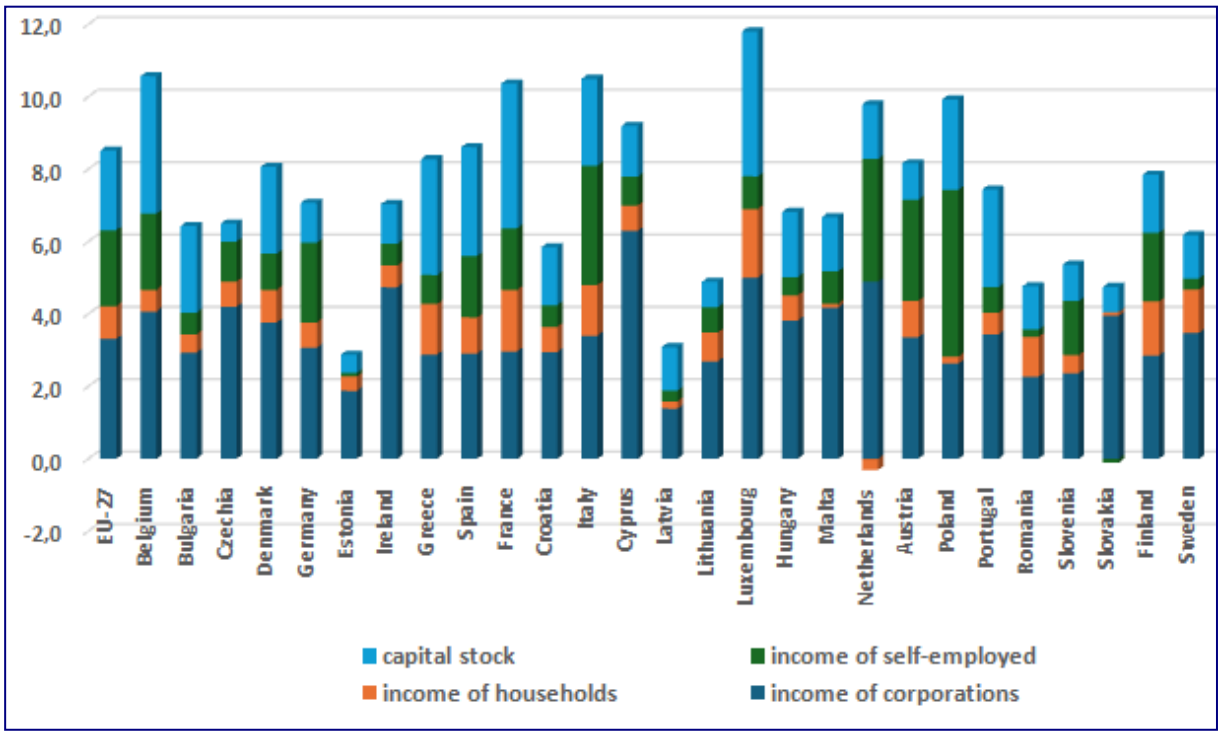
Source: European Commission, 2020, Taxation of Household Capital in EU Member States: Impact on Economic Efficiency, Revenue & Redistribution, Discussion paper130

Sweden and Finland apply a dual income tax system and completely decouple the taxation of capital income from labour income (an income tax system that uses two different tax rates for labour and capital, for example, a proportional rate for capital and a progressive rate for labour). Most other Member States apply a mixed tax approach, combining the features of a comprehensive and dual income tax system by taxing some assets inside and others outside the personal income tax system.

Within a country, the tax treatment of household capital income often also differs depending on the asset (real estate, financial assets, private pensions). *While in most Member States rental income and private pension income are taxed under the personal income tax system, income from financial assets is taxed separately by most countries.* Also, to encourage investment, many Member States use tax expenditures to favour certain types of capital income, tax expenditures that include exemptions, deductions, credits and reduced rates for certain groups of taxpayers or specific activities.

The revenues generated by taxes on household capital income, applied outside the personal income tax system, are very heterogeneous across countries. According to European Commission statistics, for the year 2023 (Figure 1), taxes on capital (8.5% of GDP) generate, on average, less revenue in the EU, compared to taxes on labour (20% of GDP) or taxes on consumption (10.5% of GDP in 2023). Within taxes on capital, taxes on household capital income are the smallest contributor (0.9% of GDP, EU-27 average), with companies contributing the most (3.3% of GDP), followed by taxation of their own employees, 2.1% of GDP, respectively the capital stock (2.2% of GDP).

Figure 1: Revenue from capital taxation in the EU, % of GDP, 2023



Source: European Commission, Data on Taxation Trends - Taxation and Customs Union - European Commission

Income from the taxation of immovable property

When considering the tax treatment of immovable property, a distinction must be made between *owner-occupied housing and rental housing*. Most Member States tax rental income under the income tax system, although the tax treatment is quite country-specific. Only Greece, Croatia, the Netherlands, Slovenia, Romania, Finland and Sweden tax rental income separately from other personal income, often at a flat rate. Italy, Latvia, Malta and Poland have a dual system, where the taxpayer can choose whether rental income is taxed separately at a flat rate (without any deductions).

Italy, Latvia, Malta and Poland have a dual system, where the taxpayer can choose whether rental income is taxed separately at a flat rate (without deductions) or calculated together with other income and taxed at the personal income tax rates. Lithuania allows the taxpayer to choose a flat rate for rental income below a certain threshold. The tax base and tax deductions also differ from country to country.

Almost all Member States use the rental income received as the tax base. Belgium uses cadastral values as an indirect indicator of the real market values of rental properties, while the Netherlands calculates taxable rental income on the basis of the value of the assets. Only thirteen Member States grant a full tax deduction for expenses related to the rental activity (Czech Republic, Denmark, Germany, Croatia, Cyprus, Latvia, Luxembourg, Hungary, Austria, Poland, Slovenia, Slovakia, United Kingdom). Other Member States cap the deduction of expenses or impose a fixed tax deduction (Bulgaria, Estonia, Ireland, Greece, Spain, France, Italy, Malta, the Netherlands, Romania and Sweden).

Owner-occupied housing is generally subject to the same property taxes, both transfer and recurring, as rented housing. Although there is a significant level of variation between Member States, property taxes are still widely used in many Member States.

For owner-occupiers, residential property is a way to maintain their standard of living after retirement; most Member States do not tax the capital aspect of owner-occupied housing and do not include imputed rent in the income tax base. Imputed rent is only taxed in the Netherlands, although even there the amount of imputed rent that constitutes the tax base is well below the corresponding market rental value. However, the exemption from taxation of imputed rent entails a significant tax cost. Recurrent property taxes can be used to partially compensate for the absence of taxation of imputed rent.

The impact of taxation on the housing investment decision is measured by *the 'user cost of housing (UCOH)' indicator*, which measures the marginal cost of capital for owner-occupied housing, i.e. the calculation of the internal rate of return of the housing investment decision.

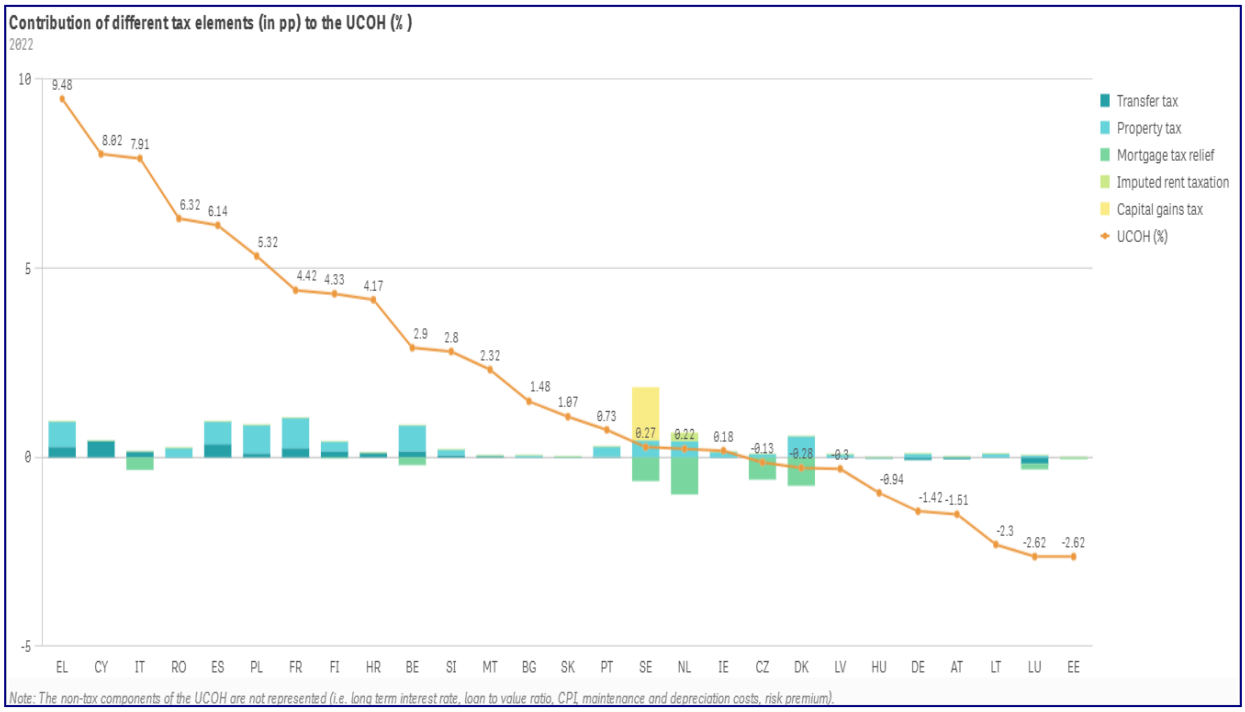
The *Owner-Occupied Housing Cost of Ownership (UCOH) indicator* is a synthetic indicator of the distortions exerted by the tax system on households' housing investment choices. The UCOH indicator measures the annual tax-adjusted cost of owning and operating the main residence as a percentage of the value of the home.

The elements taken into account in its calculation are property taxes, transfer taxes, capital gains taxes, rental taxation and mortgage interest tax exemptions.

According to the European Commission (House taxation database), in 2022, the cost of ownership of homes varied between less than 1% (Luxembourg, Estonia) and approximately 9% (Greece, Cyprus), with most values being between 0.18 and 5%. It should be noted that for negative values of the cost of ownership of homes, it is due to non-tax components, while for increasing values, property and transfer taxes predominate.

The housing cost indicator allows us to identify how different elements of the housing tax influence households' investment decisions and to isolate these contributions from developments in other factors, such as interest rates. It shows that housing taxation, and in particular recurrent property taxes, increase the housing cost of ownership for all countries, but that home ownership is still encouraged in most countries.

Figure 2: User Cost of Owner-Occupied Housing (UCOH) Indicator



Source: European Commission, https://web.jrc.ec.europa.eu/dashboard/UCOH/index.html

Over time, the contribution of the different elements of the housing tax has evolved significantly in all countries. In recent years, the housing cost indicator has shown a significant reduction in the mortgage tax exemption for new loans. Furthermore, the indicator shows that, overall, the use of recurrent property taxes has increased, indicating a more growth-friendly tax structure, but that some countries still do not apply recurrent taxes on real estate. The indicator also shows that the use of capital gains taxes is limited, but that transfer taxes are still substantial in many Member States, hampering the functioning of the property market.

Income from capital gains taxation

One possible form of taxing wealth is through taxation of the income it generates, that is, through taxes on capital gains. Most EU countries tax capital income, and in particular capital gains, at separate and lower rates than income from employment. However, there is a great heterogeneity of approaches across the EU. Some countries tax capital gains together with other personal income but offer tax exemptions (such as partial exemptions), other countries

tax capital gains separately from ordinary income, either at fixed rates (possibly with other capital income) or at progressive rates, which nevertheless tend to be lower than the rates levied on employment income.

Table 2: Capital gains tax regime

Tax regime	States
Taxed together with other personal income	Bulgaria, Czech Republic, Malta, Poland, Portugal, Romania, Slovakia, Spain
Separate capital gains tax – flat rate	Austria, Croatia, Estonia, France, Germany, Greece, Hungary, Ireland, Latvia, Slovenia, Sweden
Separate capital gains tax – progressive rates	Denmark, Finland, Lithuania
Exempt	Belgium, Cyprus, Luxembourg
other	Italy, Netherlands

Source: European Commission, 2025, Annual Report on Taxation 2025

A characteristic of capital gains is that they are usually taxed only upon realization, i.e. when the assets are sold and the value increases, due to difficulties in both monitoring and valuation.

The profit made on the sale of capital assets constitutes a realized capital gain. However, such a system may encourage tax minimization strategies, such as income shifting and deferring the payment of capital gains.

In many countries, investment income, such as dividends and capital gains, is taxed at a different rate than wage income.

Capital gains tax rates represent the maximum marginal rates of capital gains tax levied on individuals, taking into account exemptions and surcharges. If the capital gains tax rate varies in a country according to the type of asset sold, the tax rate that applies to the sale of listed shares after an extended period of time is used.

Denmark has the highest capital gains tax of all countries included, at a rate of 42%. Norway has the second highest capital gains tax, at 37.8%. Finland and France follow, at 34% each.

A number of European countries do not levy capital gains taxes on the sale of long-term shares. These include Belgium, the Czech Republic, Georgia, Luxembourg, Malta, Slovakia, Slovenia, Switzerland and Turkey. Of the countries that levy a capital gains tax, Moldova has the lowest rate, at 6%, followed by Bulgaria and Romania, at 10% each.

On average, European countries taxed capital gains from the sale of listed shares at 17.9%. The average across EU member states is 18.6%.

Taxation of wealth transfers – inheritances and donations

Inheritance taxes date back to the Roman Empire, which collected 5% of inherited property to pay soldiers' pensions. Today, the practice is widespread (Taxfoundation, 2024). The tax treatment of inheritances and donations varies considerably from one country to another. Inheritance and donation tax provisions are very complex in most countries, with different tax

schemes used, as well as varying exemptions, thresholds and conditions for specific assets and relationships.

Two-thirds of EU Member States tax inheritances and donations. 18 EU Member States tax inheritances and donations, while the Czech Republic, Latvia and Slovakia do not tax inherited wealth or assets at all. Cyprus, Malta, Austria, Portugal and Romania do not have a general inheritance tax, but they tax the inheritance of immovable property. Estonia and Sweden only tax capital gains from the sale of inherited property. Inheritance tax was abolished in Slovakia (2004), Portugal (2004), Sweden (2005), Austria (2008) and the Czech Republic (2014).

In most Member States that apply an inheritance tax, the tax rate depends on the size of the inheritance and the donor-beneficiary relationship. In other Member States, such as Spain, certain features of the inheritance tax, such as the basic tax exemption amount, depend on the relationship between the donor and the beneficiary. Of the other Member States with inheritance taxes, some have a flat inheritance tax rate that does not depend on the size of the inheritance, namely Bulgaria, Ireland, Croatia, Italy, Hungary and the United Kingdom.

However, in all these countries there is a minimum threshold below which inheritances are exempt from tax (the basic tax-free amount), which adds an element of progressivity to inheritance tax. Almost all Member States with a flat-rate system for the size of the inheritance have a progressive rate depending on the relationship between the donor and the beneficiary. The only exception with a rate that does not vary depending on either the size of the inheritance or the relationship between the donor and the beneficiary is the United Kingdom.

Some Member States apply specific rules for the taxation of inheritances of immovable property and family businesses. In eight Member States, immovable property inherited by closely related beneficiaries benefits from a partial or total tax exemption. In some Member States, this exemption is limited to homes or residential properties.

As regards the transfer of family businesses, eight Member States have specific rules reducing the inheritance tax liability. This special tax treatment is often influenced of certain conditions, such as continuing the business for a certain period of time after the transfer. Estate taxes are levied on the deceased's estate and paid from the estate itself. Inheritance taxes, on the other hand, are levied only on the value of the transferred assets and are paid by the heirs. Gift taxes are levied when property is transferred by a living person.

Countries typically only levy inheritance or inheritance taxes. However, estates can be taxed twice if they fall under two jurisdictions that apply different taxes. For this reason, European Union member states have put in place mechanisms designed to prevent or mitigate double taxation if such a situation arises.

Inheritance, donations and gift taxes have limited revenue-raising capacity, but they have a negative impact on entrepreneurial activity, savings and work.

The tax rates applied to real estate, inheritances and gifts often depend on the level of family closeness to the heir, as well as on the amount inherited. For example, in France, different rates apply to transfers to ascendants and descendants, transfers between siblings, blood relatives up to the fourth degree and all others. For transfers to ascendants and descendants, as well as between siblings, higher rates apply to larger amounts of money.

In some countries, such as Belgium, Spain or Switzerland, the rates of estate, gift and inheritance taxes also vary by region. Most European countries do not tax transfers below a certain amount.

All Member States that tax inheritances also levy taxes on donations. Taxation of donations is usually done in the form of a separate donation tax. Latvia and the Czech Republic are the only Member States that do not tax inheritances, but tax donations under certain conditions. Several approaches to the taxation of donations are applied across the EU: donations are treated either as "extraordinary" income (with reference to the overall definition of income), or as "advance" inheritances, or both as income and inheritances. When donations are considered as "advance" inheritances, the donation tax is designed to be close to that of inheritance tax. The tax models for inheritance and donation taxes are even identical in Germany, Croatia, Italy, Poland and Slovenia. However, a reduced exemption threshold may be applied to the donation tax to take into account the possibility of repeating or dividing donations over time, which is clearly not possible in the case of inheritances. Finally, some Member States facilitate transfers before death by granting more favourable tax treatment to donations than to inheritances, for example through a higher tax exemption threshold or a reduced tax rate.

In general, inheritance and gift tax revenues represent a very small share of total tax revenues. The share of all property taxes in total tax revenues varies from around 1% in Slovakia (1.2% of total taxation) to 8.4% in France. Inheritance and gift tax revenues constitute only a fraction of total property taxes, around 0.3% of GDP on average in the EU (the lowest value in Irland and Greece, of 0.1 % and the highest, of 0.7%, in France).

Conclusions

The tax system can influence households' investment decisions, namely their decisions on how much to invest, when to invest and in which assets to invest. The way in which capital is taxed also has an impact on households' disposable income, which can become essential during periods of unemployment or retirement, when they can no longer rely on their income from work.

In this paper, we have carried out a theoretical analysis of the tax treatment of household capital income across EU Member States, specifically income from specific assets (houses), capital gains, inheritances and donations/gifts. It should be noted that these taxes do not generate significant revenue for state budgets, but they are a source that can increase revenue efficiency and make the tax system fairer.

Housing is often one of the most important investments of households, and governments generally favour home ownership through their tax system. Given the wider benefits that home ownership brings to society, most Member States use the tax system to encourage home ownership, mainly through tax exemptions on imputed rent and/or generous mortgage tax relief.

Although preferential tax treatment of capital gains is usually aimed at increasing savings and investment, its effectiveness is uncertain. Comprehensive taxation of capital gains helps to protect the income tax base by reducing the incentive for taxpayers to convert ordinary taxable income into capital gains. By reducing the potential for tax avoidance through selective realisation of capital losses, capital gains taxation on an accumulation basis contributes to tax neutrality and economic efficiency. In practice, however, capital gains are taxed when they are realised and can create potential inefficiencies resulting from a lock-in effect. Many Member States try to mitigate this effect by levying lower or no tax on capital gains from assets held for a long period. While aimed at increasing savings and investment, this type of preferential tax treatment of capital gains can lead to sub-optimal diversification of investment portfolios.

Reforming inheritance and gift taxes can increase the efficiency of the tax system and generate additional revenues; however, for an inheritance tax to be effective, it must be accompanied by a gift tax, the design of which could encourage earlier transmission. To ensure revenue efficiency, inheritance and gift tax reforms also need to take into account potential offshore tax avoidance and evasion.

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SMART TRANSFORMATION IN MOLDOVA'S AGRICULTURE

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Abstract:

The Moldovan agricultural sector stands at a crossroads, facing challenges such as climate volatility, labor migration, and low productivity. Yet, the digital era opens unprecedented opportunities to leapfrog traditional limitations. This paper explores Moldova's potential to harness digital innovation in agriculture by aligning global technological trends—like AI, IoT, and data platforms—with local realities. Drawing on recent insights and studies, the article evaluates key enablers of transformation: digital infrastructure, governance, public-private partnerships, farmer-centric innovation, and other enabling pillars. Results highlight strong digital infrastructure achievements at national level alongside persistent rural gaps, nascent agri-tech ecosystems, and urgent needs in data governance, farmer training and finance.Moldova's path to smart agriculture is examined through comparative case studies and evidence-based policy recommendations, setting a blueprint for a resilient, tech-driven rural economy.

Keywords: *digital agriculture, smart farming, innovation in rural Moldova, agricultural transformation*

JEL Classification: *Q10, Q13, R10.*

Introduction

The Republic of Moldova is a country with an agricultural tradition, fertile lands (especially black soils on about 75% of the agricultural area), but also with multiple challenges that prevent it from realizing its full potential. Among them: climate fluctuations (drought, uneven rainfall), soil degradation, labor migration (especially young people to cities and abroad), limited access to financing and modern technologies for small and medium-sized farms, and a value chain that often does not maximize local added value.

In recent years, digitalization, automation and smart technologies (IoT, sensors, artificial intelligence, mobile and data applications, drones, etc.) have become essential factors at a global level for increasing productivity, improving sustainability and for resilience in the face of shocks — climatic, market or external. An essential factor is the positioning of the IT sector in the Republic of Moldova and the essential progress achieved by them thanks to the

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favorable fiscal regime.The contribution of the IT sector to the national GDP exceeds 6% and estimates to grow over 30% by the end of 2025, according to MITP insights.

The article was developed within the framework of Subprogram 030101 „Strengthening the resilience, competitiveness, and sustainability of the economy of the Republic of Moldova in the context of the accession process to the European Union", institutional funding.

The objective of this article is to provide a comprehensive analysis of how the Republic of Moldova is prepared to make the transition to smart agriculture, to identify barriers and opportunities, and to propose a set of policies, interventions and a monitoring framework to support the transformation.

Structure of the article: review of the literature and international context, analysis of the current state in Moldova, practical recommendations, economic implications and conclusions.

Literature Review

At the international level, less than at the national level, significant efforts are noted in terms of studies and research that analyze and offer clear perspectives on the integration of technologies with agriculture.

Recent international literature provides both conceptual frameworks and practical guides for the design of national digitalization strategies in agriculture. FAO has made available the E-Agriculture Strategy Guide, a practical tool for the development of national e-agriculture strategies covering data architecture, ICT infrastructure, governance and services for farmers. This guide details diagnostic steps, multi-stakeholder consultation and phased implementation, emphasizing the importance of interoperability and "last mile" services for farmers.Also worth to mention that the guide was adopted in various countries.

ITU, in cooperation with FAO, has consolidated good practices and recommendations for countries in Europe and Central Asia — including a compendium / guide intended for countries in the pre-accession round — with technical and policy recommendations for alignment with EU standards on digital agriculture (API, interoperability, broadband mapping, data protection). The ITU-FAO document includes architectural models (open data platforms), technical specifications for monitoring and examples of public policies.

The World Bank and its documents on digital progress (Digital Progress & Trends Report, 2023) provide macro context: digitalization must be integrated into sectoral strategies to generate distributed economic benefits, but requires inclusive policies to prevent the deepening of the "digital divide". The World Bank report also provides methodological tools for measuring digital progress at the national level.

Operationally, the Data for Digital Agricultural Transformation (MPTF / UN joint programme) was launched in 2024, aiming to strengthen data capacities and platforms for digital agriculture in participating countries, coordinating efforts by FAO, IFAD and UNDP for 2024–2027. This programme is relevant for Moldova as it allocates resources for data components (farm register, weather data, agricultural data hub) and for piloting digital services.

FAO maintains an active presence in Moldova and the region — FAO reports and project fiches for Moldova (including projects to strengthen the resilience of smallholders and drought assistance) include digitalisation components for outreach and monitoring. FAO focuses on digital integration in climate adaptation measures and technical support for scientific data.

UNDP Moldova has expanded the digitalisation agenda to sectors (including agriculture) and includes digital transformation actions targeting data governance and institutional capacity, as mentioned in the country reports. UNDP is a potential key actor in coordinating the social and governance components of agricultural digitalization.

There is a growing number of applied analyses and studies regarding digitalization in Moldova, both academically and operationally/institutionally:

-ITU – Broadband mapping & technical specifications for Moldova. ITU has published a technical paper on the specifications for the development of a broadband mapping system in the Republic of Moldova, an essential tool for rural connectivity planning (identifying the “last mile” and uncovered segments).

-Local and regional academic studies. There are articles and scientific papers that analyze the prospects for digitalization in Moldovan agriculture, including examinations of the potential for implementing Industry 4.0 products, analysis of integration in agricultural education, and papers on the perception of local actors.

-Agricultural data research (case studies / data science). A study published in ACM explores the types of data produced in Moldovan agricultural sciences and discusses the benefits of opening up this data for research and practical applications — emphasizing the need for open standards and formats for data to be reusable. This is a direct source for data architecture recommendations.

-Local practical evaluations and pilot initiatives. Practical examples include the AGRODAT.MD platform, which provides soil temperature and precipitation maps, sowing recommendations, and agro news; and the UNIFORM AGRI system for livestock management, presented in 2024-2025 as a solution with the potential to reduce losses on livestock farms.

Methodology and Data

The author used a mixed research toolkit to integrate statistical evidence with existing literature:

-Systematic review of institutional literature, FAO, ITU, World Bank, UNDP, EU reports, as well as Moldovan government publications (Ministry of Agriculture, ANSA, etc.).

-Analysis of statistical data provided by relevant institutions with direct access to them: macroeconomic indicators (productivity, production volume, structure of agricultural products), digital indicators (connectivity, digital services), data on local initiatives (platforms, incubators, smart technology projects).

-Examples of local good practices

Limitations

Lack of national-scale surveys measuring the adoption of smart technologies at farm level (especially small farms) — often selective / pilot arrangements.

Aggregated statistical data that do not allow for clear dissection into very peripheral rural regions vs. close to urban.

Limited possibilities of accessing real-time data regarding technology costs, maintenance, water or energy consumption associated with sensors, irrigation, etc.

Results

Contribution of agriculture to the economy

Official data indicate strong fluctuations in the value of agricultural production: gross agricultural production recorded a strong increase in 2023 compared to 2022 (+23.6% according to statistical reports/public reports), against the background of an increase in crop production (+35.1%) and a slight decrease in livestock (−1.9%). These figures show the annual volatility and the importance of the sector for food security and rural incomes.

As a share of GDP, the variability of the indicators depends on the methodology; conventional estimates place the value added of agriculture at the level of relevant percentages (differences between sources), but the evidence shows that the sector remains important for employment and exports (including value-added agri-food products).

IT / ICT sector evolution

The IT sector in Moldova has grown substantially in recent years: according to official / institutional sources (invest.gov.md and sector reports), total IT sector revenues exceeded approximately EUR 600–650 million (recent aggregate reports indicate €649M for 2023, ~31% increase vs 2022) and the fiscal contribution (taxes/payments) has increased significantly (e.g. €68M contribution to the budget in 2023). These figures show that ICT is a growing economic pillar and a source of skills for agricultural digital integration.

ICT exports (software, services) represent an important part of service exports — sector reports note values of tens-hundreds of millions of USD annually (varies depending on the methodology and year).

Digital infrastructure

The EU4Digital Profile for 2021–2023 reports a household broadband take-up of ~93% in 2023, and the fixed broadband penetration rate in some statistics (fixed take-up) appears high (~86% according to the profile). National internet usage data (DataReportal) reports 2.14 million users and internet penetration of ~63.5% of the population in early 2024 — the differences come from different measures (households vs individuals). These figures confirm the existence of a strong basic infrastructure at national level, but they do not cancel out the quality/latency gaps in rural areas.

While ICT is growing rapidly (income, exports, skills), agriculture remains a vulnerable sector with high potential to benefit from ICT skills. The convergence of these sectors (IT + agriculture) is possible and is already starting to materialize in incubators, platforms and university centers.

Broadband penetration / last-mile capacity (2021–2023): household broadband take-up 93% (2023), fixed broadband ~86% (EU4Digital). This level means that a large share of farms can access digital services if they are adapted to rural conditions (mobile applications, offline/interrupted services).

Skilled IT workforce: the IT ecosystem produces thousands of specialists annually (developers, data scientists, IoT engineers) — these skills can be pivoted towards agri-tech (data/telemetry application development, satellite image analysis, ML for forecasting). Government and ministerial reports indicate an increase in ICT revenues and exports, which supports the availability of domestic skills.

National platforms that supports transition

Locally, different initiatives have been made in order to cross-cut and make the agriculture transition efficient and smooth. Some of existing local initiatives created by key stakeholders, including academia can be mentioned:

-AGRODAT.MD - platform that offers agro-climatic maps (soil temperature, precipitation), sowing recommendations and other decision-making support tools for farmers.

-ANSA - The National Food Safety Agency and the Electronic Governance Agency launched digital services (certifications, online payments) and announced Moldova's connection to global networks for e-certification (ePhyto hub, 2025).

-Center for Smart Agriculture (CoSA) — Technical University of Moldova (UTM) - university demonstration center (drones, smart irrigation, laboratories), created with support from USAID/OPTIM (Switzerland).

Regulatory framework

Nowadays, the regulatory framework is progressive and tends to digitalize the sectors. Some of the main documents that regulates local context in terms of agriculture and digitalization can be mentioned:

1. National Strategy for Agricultural and Rural Development (NSARD) 2023–2030 — is the main sectoral strategy that includes components on the digitalization of agricultural services, modernization of value chains and climate resilience.

2, Digital Transformation Strategy (Moldova) 2022/2023–2030 — establishes the framework for the development of digital infrastructure, data governance and digital public services. The document is a key tool for aligning sectoral policies with technological standards and EU requirements.

3. Food Security Strategy 2023–2030 / Action plans — includes measures to ensure food traceability, strengthen the response to climate risks and digitize key procedures for agricultural trade.

4. Initiatives and plans related to interoperability and e-services — The Government approved programs and platforms for e-government, and ANSA & the Agency for Electronic Governance launched digital services for certification (2024–2025), which are operational. For example, joining the ePhyto Hub (July 2025) reflects alignment with international e-certification regimes. These instruments are in place and directly influence administrative procedures for agricultural exports.

Recommendations

To ensure a synergistic integration between the agricultural sector and ICT, interventions are needed both at the policy level and at the level of national and local initiatives.

A. Policy recommendations and strategic interventions

1. National strategy and data governance

1.1. National Plan for Digital Agriculture 2026-2030 or/and National Strategy/Program for the Digitalization of Agriculture

Development of an integrated strategic plan that includes all components: infrastructure, data, financing, pillars for stimulating and facilitating digital transformation, training and education. This should be coordinated by an interministerial body (Agriculture, Digitalization, Environment, Finance) and should be consulted with farmers, agricultural unions, research and the private sector.

1.2. National interoperable agricultural data platform

Creation and management of a digitized farm register, land and soil register, local meteorological data, plant and animal health data, traceability. API standardization (for private/public platforms), personal and agricultural data protection, controlled open access.

1.3. Regulations and standards

Alignment with EU norms on traceability, food safety, ecological certifications, but also with technical standards for IoT systems and sensors (calibration, interoperability, cybersecurity).

B. Access to infrastructure and technologies

1. Accelerated rural connectivity

Expanding fixed and mobile broadband networks in rural areas, reducing the cost of connections, subsidizing subscriptions for low-income farmers. Also, ensuring stable energy supply and access to renewable energy sources (solar panels, photovoltaic stations for pumps, etc.).

2. Pilot programs for sensing and precision

Implementing a number of demonstration farms in several regions, equipped with humidity sensors, smart irrigation, drones, local weather stations. Pay-per-use models or technological leasing would be useful for small farms. Applying precision agriculture principles in model farms.

3. AgriTech incubators and innovation centers

Supporting incubators such as Agrotek Arena, CoSA, but also the development of micro-incubators in districts, connected to universities and research centers. These should provide prototyping infrastructure, laboratories, access to data, mentors and seed funding.

C. Financing and support

1. Blended finance schemes

Combining grants, preferential loans and guarantees for the provision of smart technologies. For example, partial subsidies for IoT equipment, irrigation, drones; guarantees for agricultural loans that include a digital component. Even though financing through ODA has increased in recent years, at the national level we can mention the decrease in support from development institutions and partners, especially with the closure of the USAID office.

2. Micro-leasing / technology leasing

Allows small farmers to access expensive equipment (sensors, smart pumps, automation systems) by paying in installments from the savings generated by use (water, inputs, labor).

3. Fiscal incentives

Tax reductions for the import of modern agricultural equipment and technologies, exemptions for investments in digitalization, tax deductions for farms that adopt green and smart technologies.

D. Training, human capital and digital culture

1. Digital extension – e-extension

Development of digital advisory services (through applications, SMS, chatbot, video, radio) specifically adapted to the local language, level of education of farmers, with practical demonstrations.

2. Training and awareness programs

Bootcamps, courses in universities in the field of digital agriculture, workshops in rural communities. Support for young innovators, aspiring farmers.

3. Innovation and Collaboration Events

Thematic Hackathons, AgriTech competitions, collaborations between universities, research and the private sector.

Conclusions

The Republic of Moldova is at a favorable moment for the smart transformation of agriculture. Digital infrastructure, government commitments and local initiatives are already concrete signs of progress. But for this potential to become a concrete effect at scale, an integrated approach is needed: a clear national strategy, data governance, access to finance, digital infrastructure and skills, and piloting to generate local evidence.

A national pilot program that combines sensors, digitalization of extension services, tailored financing and training is essential to demonstrate feasibility, costs and benefits. Once validated, these models can be scaled up, contributing to increasing productivity, reducing climate risks and improving lives in rural areas.

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SECTION II. FINANCIAL AND MONETARY CHALLENGES

DIGITALIZATION AS A DRIVING FACTOR IN THE TRANSFORMATION OF BUSINESS PROCESSES IN THE BANKING SYSTEM

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Abstract:

In recent years, the banking business has undergone significant transformation under the influence of the digitalization of the environment and business. Banking products and services, driven by new economic phenomena and information technologies, are changing and modernizing. The issue of an effective path for the development of the banking system has become particularly relevant in the context of the rapid digitalization of economic activity. The application of modern technologies by banks fundamentally contributes to reducing costs and increasing revenues. The purpose of the research on the topic is to analyze the transformations of the banking business under the influence of digitalization and to identify the most effective ways to ensure the sustainable development of the banking system. This research aims to highlight how modern technologies contribute to the modernization of banking products and services, the reduction of operational costs, and the increase of revenues, especially in the context of the rapid digitalization of economic activity.

Keywords: *digitalization, banking system, banking business*

JEL classification: *G21, L21*

Introduction

Against the background of contemporary trends in the development of the financial sector, the role of digital technologies in transforming key aspects of commercial banks' activities is increasingly emphasized, and in these conditions, the need to increase the competitiveness of commercial banks by enriching the customer experience and optimizing internal business processes is becoming increasingly relevant.

The digitalization of the economy assumes that business processes change in two directions:

– First - all communications are transferred to digital channels for transmitting information;

– Second - total or partial automation of business operations takes place.

In recent years, banking activity has significantly transformed under the influence of the digitalization of the environment and business. The main directions of the transformation of

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banking business are:

a) digitalization (purpose: increasing sales through digital channels);
b) technologies (purpose: restructuring traditional banking functions for the creation and implementation of products and services in the ecosystem);
c) ecosystem (purpose: the commercial bank will act as a new element of the client's lifestyle).
Modern financial technologies have allowed the state, business environment and the population to move to new ways of interacting with each other. Banking information technologies have changed the behavior of the population and the business environment, influencing the development of competitive advantages of commercial banks.

To obtain financial services, customers access financial services through multiple channels and use online platforms to interact with commercial banks, which highlights the central role of digitalization in the evolution of the banking sector.

Until 2019, banks prioritized working on the front-end of banking products and optimizing customer operations. Currently, priorities have shifted toward innovations in the back office, particularly in the development of services, default management, and the digitalization of internal business processes. In addition, for example, corporate lending divisions now have new opportunities to learn from the use of artificial intelligence by fintech companies and from alternative data to make faster underwriting decisions regarding client lending [2, p. 17].

In the context of the intensive implementation of artificial intelligence, blockchain, cloud computing and biometric authentication technologies, the traditional business models of commercial banks are undergoing a significant revision.

Business models describe what value the company is providing to customers and partners and how it is translated into revenue [8]. Business models represent selected pieces of how the company transforms resources and creates relationships among other market participants [1]. Business models are often considered one-page canvas-like sketches describing (new) value propositions, and accompanying and supportive items leading to the provision of crafted value.

Business model innovation means changing one or more of the components of a business model or their interactions [3]. It can be driven by the need to react to a new customer need (customer-led), by innovation or implementation of new emerging technology or mainstream technology in evolutionary state (technology-led), or necessity or need to improve normal workflows and structures that facilitate the workflows (organisational development-driven) [4].

Banks are compelled to adapt to the new realities of the digital economy, where the key factors of competitiveness are service speed, offer personalization, and the ability to integrate into ecosystems.
The scientific problem lies in the insufficient study of the mechanisms underlying the transformation of banking business models and the identification of optimal strategies for adapting to current digital challenges.
The fundamental driver of the transformation of banking business models is the large-scale implementation of artificial intelligence and machine learning technologies. According to expert estimates, global bank spending on generative artificial intelligence systems amounted to approximately 6 billion USD in 2024 and is expected to increase to 85 billion USD by 2030. [10].

Literature Review

Digital transformation represents a complex process of business activity transformation based on the use of digital technologies and involves a fundamental reconsideration of how a commercial bank operates and how it interacts with its environment. The digital transformation process incorporates everything related to the application of innovative technologies in operations, as well as what we call the change of business processes and the methods of implementing products.

The main objectives of digital transformation are:

1. Increasing the quality of customer service;
2. Reducing service delivery times;
3. Reducing costs through automation.

The definition of the essence of digital transformation in the banking system should be considered together with the concepts of:

– digitalization of financial and banking activities (improving banking structures, products, and methods of customer interaction through the use of digital technologies, leading to increased profitability);

– financial technologies (FinTech) (the application of the latest technologies and organizational innovations that allow the provision of financial services at a higher level of utility or, in simple terms, faster, cheaper, and of better quality);

– digital banking (the delivery of financial services via mobile and online platforms, which improves the quality of the bank–customer relationship, saves time and costs, enhances the security of personal data, and improves the speed and quality of services).

The digital transformation of the banking system, taking into account global trends, is developing along the following priority directions:

1. Open banking APIs (in the IT world, an Open API represents the “sharing” of a product’s interface and functionalities with third-party developers, partners, or other actors in the ecosystem. They integrate the API into their services/applications, making them more convenient and functional. Thanks to APIs, it is possible to log in to third-party websites via Facebook, order a taxi based on your geolocation, or make payments in a few steps in online stores. Services integrate with each other, making our lives easier);
2. HR processes in banks and IT staffing;
3. Development of cashless payments;
4. Key aspects regarding the regulation of outsourcing and banking ecosystems;
5. Personal data protection: key aspects and stages for ensuring compliance with regulatory acts.

Digital transformation allows banks to move to a new level of competition: between digital and traditional banks; between fintech companies and traditional banks; and in specific services or processes.

The reason for digital transformation lies in new areas of competition for clients. The emergence of digital banking is a response to changing customer needs: the new client demands a personalized approach and wants to receive attractive offers from the bank not only when visiting its branch but also in their everyday life. Personalized interaction with

clients provides banks with unlimited opportunities to attract them, regardless of demographic factors or the level of use of information and communication technologies in the country.

Banks must learn to meet the expectations of clients from different generations, which means they need to align with the current digital expectations of their customers and develop banking and financial services based on their preferences. The implementation of digital innovations leads not only to digital transformation but also to a change in the bank's business model.

In the context of digital transformation, banks face the question: ecosystem or traditional bank?

The business model represents a conceptual description of banking activity. When creating a business model under digital transformation, banks adopt two approaches: the ecosystem approach and the traditional approach.

In the case of the traditional model, banks can also participate in the digital transformation process and implement digital technologies; however, their source of income remains traditional, meaning it generally comes only from banking activities, including both interest income and income from additional financial services. In this case, the way the activity is conducted remains strictly banking.

The ecosystem approach changes the business model, where banking becomes just one of multiple businesses within a broader ecosystem that functions as a platform for various entities. By adopting an ecosystem business model, the bank ceases to be, in the classical sense, a bank and becomes a platform solution that brings together different lines of activity. In this approach, the business strategy changes, and revenue comes not only from banking activities but also from other companies within the ecosystem. Sometimes, banking may no longer be the main source of income for the ecosystem. Thus, in the ecosystem business model, the bank is no longer understood in the traditional sense as a bank but as a platform solution that integrates various areas of activity.

It seems that the bank of the future will offer clients not only financial services. First and foremost, the bank of the future is perceived as a digital ecosystem that will provide both financial and non-financial products. While financial services have so far been the primary focus, in the development stage of banking ecosystems, they will accompany and support the provision of non-financial services. In other words, the bank as a digital ecosystem will be oriented toward meeting all the needs of its clients. There is an approach that considers the bank of the future as a "semantic bank."

One of the leading figures in the fintech directions of banking, in the context of digital transformation, is Chris Skinner, an independent financial markets observer and author of ten books—*The Digital Man*, *Banking in a Globalised World*, *The Digital Bank*, *How to Create a Digital Bank or Become One*. The researcher has been working for over 30 years on the digital transformation of traditional banks and proposes an original project for the future: the "semantic bank."

Skinner believes that, based on fintech products in the field of cryptocurrencies, the semantic bank will be created, which will be the opposite of the traditional bank. The semantic bank will operate effectively within the infrastructure of the three most advanced generations of internet technologies that will emerge in the future:

- Third generation – Web 3.0, Value Web;
- Fourth generation – Web 4.0, Internet of Things;
- Fifth generation – Web 5.0, Internet of Life [9].

Thus, the development of banks' digital ecosystems at the current stage can be considered a strong competitive advantage, allowing the provision of a personalized approach to the client by offering all types of services in a single place.

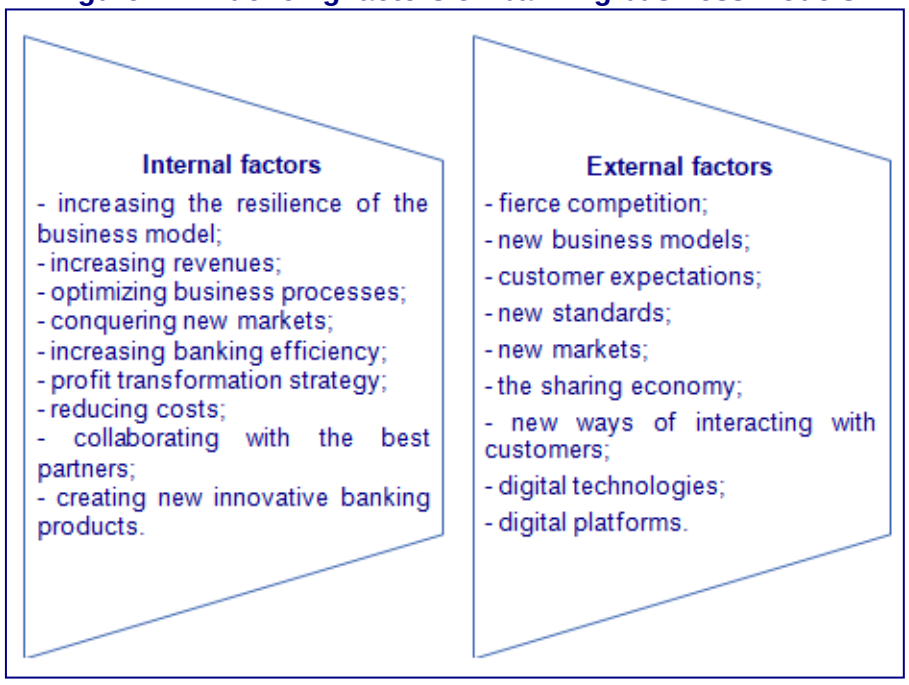
Methodology and Data

It should be acknowledged that the digital transformation of the financial-banking sector does not consist solely in the application of innovative digital technologies by banks, but also in changing the bank's business model from a traditional one to an ecosystem-based model. The development of digital banking ecosystems at the present stage can be considered a strong competitive advantage, allowing banks to offer a personalized approach to their clients by providing, in a centralized manner, all types of banking services needed by consumers.

World Bank experts assume that by 2025, digital banks could completely replace traditional banking institutions in the market, leading to radical transformations in the financial and banking system. It is estimated that the bank of the future will offer clients not only financial services, but also personalized digital solutions, lifestyle support, and integrated platforms that connect financial, technological, and social experiences.. The development of digital ecosystems, and in some cases their integration, leads to a shift in the essence of competition in the markets, which is important for other players who do not possess such digital ecosystems to consider and to respond promptly to their emergence and development.

Any transformation of an organization's business processes affects its business model. Digital processes and their development within a commercial bank must be focused on significantly increasing product value, reducing risks from competitors, and creating or improving the value proposition.

Figure 1: Influencing factors on banking business models


Internal factors
- increasing the resilience of the business model;
- increasing revenues;
- optimizing business processes;
- conquering new markets;
- increasing banking efficiency;
- profit transformation strategy;
- reducing costs;
- collaborating with the best partners;
- creating new innovative banking products.
External factors
- fierce competition;
- new business models;
- customer expectations;
- new standards;
- new markets;
- the sharing economy;
- new ways of interacting with customers;
- digital technologies;
- digital platforms.

Source: elaborated by the authors

The most important aspect for the modern banking sector, in terms of maintaining customer loyalty and attracting new clients, is the continuous monitoring of customers' attitudes toward existing financial (banking) services and maintaining their interest by implementing new convenient services that differentiate the bank from others. Under current conditions, the efficiency of banking activity is no longer determined primarily by the traditional calculation of profit obtained from the sale of certain financial products, but by customer loyalty and the focus on their opinions and needs, which must be satisfied by modern banks.

Below, in table 1, the five stages of digital transformation in the banking sector are presented.

Table 1: The stages of digital transformation in the banking sector

The stage	Name	Content
The stage 1	Canal digital	Internet banking, mobile banking, chatbots. The user who wants to interact with the bank through any available channel at a convenient time is at the center of the ecosystem.
The stage 2	Produs digital	Big data, contactless payments, virtual cards, artificial intelligence, technology. With the help of modern software, E2E (end to end) products are created, designed to satisfy the financial needs of customers within 24 hours.
The stage 3	The Complete Digital Cycle	Banks are not only adding digital services to traditional products, but also creating new digital businesses, completely changing business models and expanding the boundaries of business.
The stage 4	"The Digital Brain"	The "digital brain" continuously and automatically studies data from all business segments, departments, product lines and services, providing the organization with a deeper understanding of its own capabilities.
The stage 5	"The Digital DNA"	A new coordinate system for making strategic decisions throughout the entire life cycle of the bank.

Source: elaborated by the authors based on the data [8]

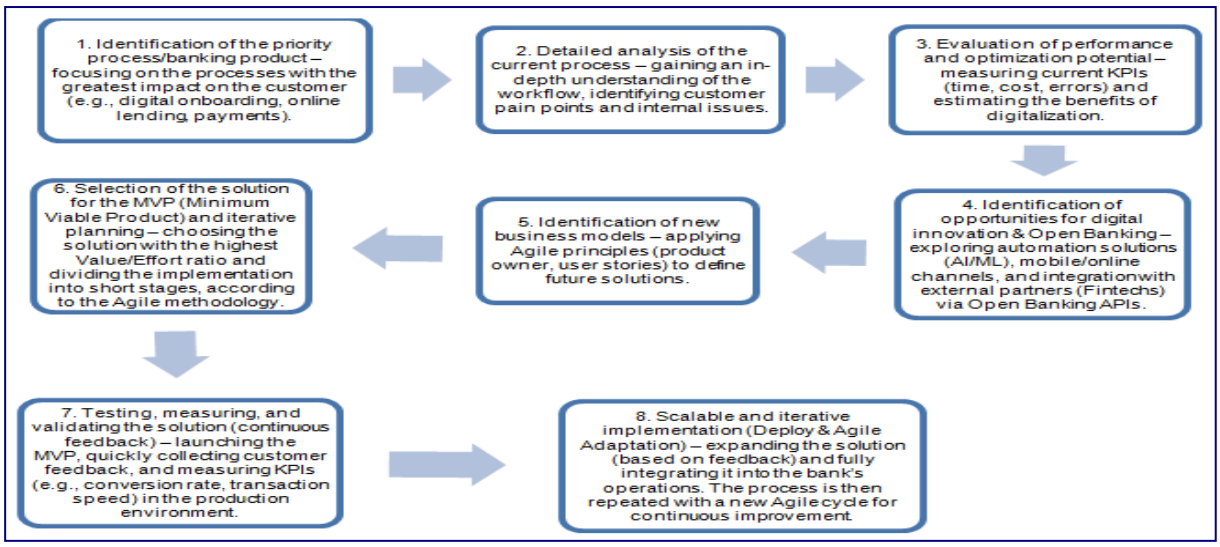
The main trend in the banking sector can be considered the focus on developing operational models, which is reflected in customers' growing desire to access banking services outside of branches – remotely. The implementation of digital technologies in banking activities is becoming a key direction that supports modern trends. These changes contribute not only to improving customer service but also to shaping new approaches to financial management.

As a result of the continuous implementation of digital solutions and financial innovations, there arises a need to create an integrated space that connects the banking sector with the digital environment.

Such an approach allows banks to adapt to rapidly changing market conditions and customer expectations. The digitalization of processes, including the automation of operations and the use of data analytics, opens new opportunities for increasing efficiency and enhancing the customer experience.

In the current context of the financial market, characterized by the continuously growing demands of clients and the competitive pressure from Fintech companies, digital transformation is no longer an option but a strategic necessity (figure 2).

Figure 2: The stages of the digital banking transformation process


1. Identification of the priority process/banking product – focusing on the processes with the greatest impact on the customer (e.g., digital onboarding, online lending, payments).
2. Detailed analysis of the current process – gaining an in-depth understanding of the workflow, identifying customer pain points and internal issues.
3. Evaluation of performance and optimization potential – measuring current KPIs (time, cost, errors) and estimating the benefits of digitalization.
4. Identification of opportunities for digital innovation & Open Banking – exploring automation solutions (AI/ML), mobile/online channels, and integration with external partners (Fintechs) via Open Banking APIs.
5. Identification of new business models – applying Agile principles (product owner, user stories) to define future solutions.
6. Selection of the solution for the MVP (Minimum Viable Product) and iterative planning – choosing the solution with the highest Value/Effort ratio and dividing the implementation into short stages, according to the Agile methodology.
7. Testing, measuring, and validating the solution (continuous feedback) – launching the MVP, quickly collecting customer feedback, and measuring KPIs (e.g., conversion rate, transaction speed) in the production environment.
8. Scalable and iterative implementation (Deploy & Agile Adaptation) – expanding the solution (based on feedback) and fully integrating it into the bank's operations. The process is then repeated with a new Agile cycle for continuous improvement.

Source: compiled by the authors based on the data [4]

The presented diagram illustrates the end-to-end lifecycle of digitalization initiatives within the commercial bank, ensuring a fast, customer-oriented, and flexible approach. This framework integrates three key pillars:

1. Digitalization of banking activities – focusing on automating internal processes and migrating services to digital channels (mobile and web) to increase operational efficiency and enhance the user experience;

2. Agile methodology – adopting an iterative and flexible approach that enables rapid value delivery through the launch of MVPs (Minimum Viable Products). Success is constantly measured through customer feedback, ensuring that the developed solutions meet real market needs;

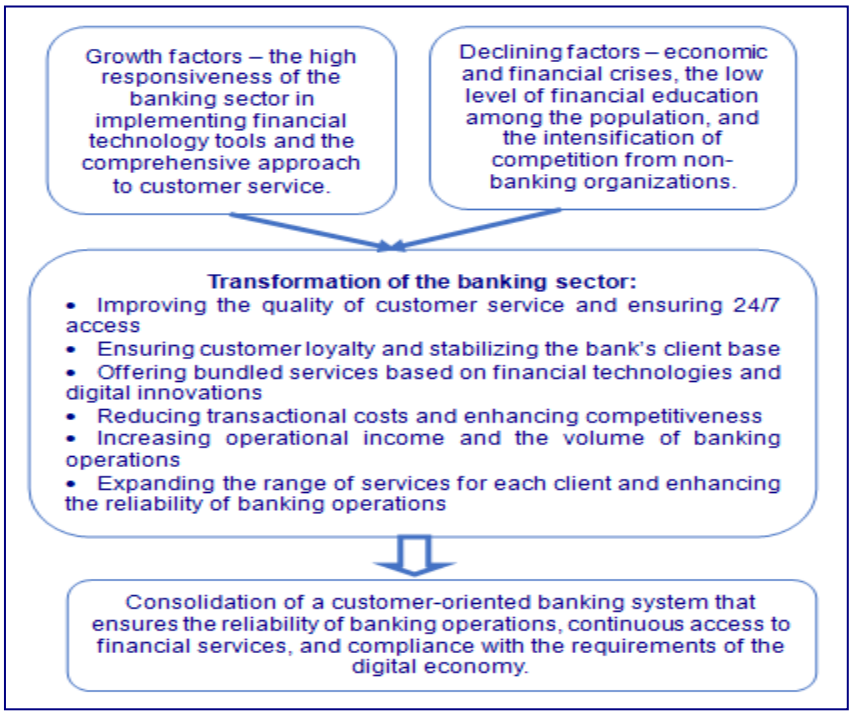
3. Open Banking – proactively exploring PSD2 (or equivalent) standards and APIs to facilitate strategic partnerships. This allows banks to expand their service offerings through integration with external ecosystems, transforming the bank into an open and innovative financial hub.

Each stage of this process, from identifying the priority process to scalable implementation, is designed to maximize customer-added value and strengthen the bank's position in the digital era.

It is important to note that creating a unified space between financial services and digital technologies not only simplifies interactions but also contributes to the development of new products and services that meet the needs of the modern user.

The mechanism reflecting the transformation of the national banking system under the influence of various factors is presented in figure 1.

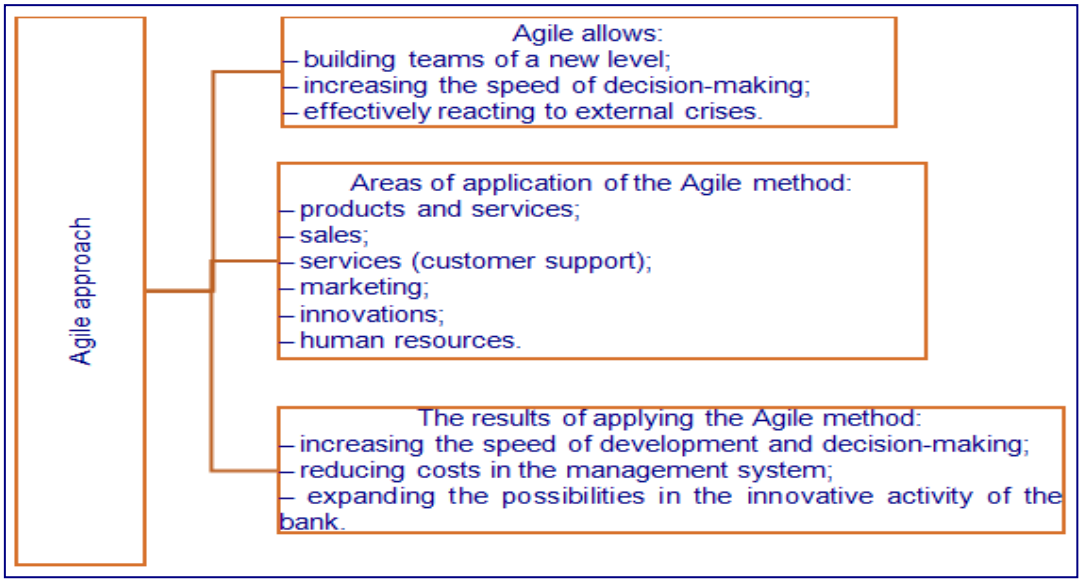
Figure 3: The mechanism for transforming the banking sector with the implementation of financial technologies


Growth factors – the high responsiveness of the banking sector in implementing financial technology tools and the comprehensive approach to customer service.
Declining factors – economic and financial crises, the low level of financial education among the population, and the intensification of competition from non-banking organizations.
Transformation of the banking sector:
• Improving the quality of customer service and ensuring 24/7 access
• Ensuring customer loyalty and stabilizing the bank's client base
• Offering bundled services based on financial technologies and digital innovations
• Reducing transactional costs and enhancing competitiveness
• Increasing operational income and the volume of banking operations
• Expanding the range of services for each client and enhancing the reliability of banking operations
Consolidation of a customer-oriented banking system that ensures the reliability of banking operations, continuous access to financial services, and compliance with the requirements of the digital economy.

Source: elaborated by authors

The Agile model allows the team to perform actions consecutively and ensure rapid implementation. The implementation of the Agile strategy is presented in figure 4.

Figure 4: The steps to follow for the Agile method


Agile approach
Agile allows:
– building teams of a new level;
– increasing the speed of decision-making;
– effectively reacting to external crises.
Areas of application of the Agile method:
– products and services;
– sales;
– services (customer support);
– marketing;
– innovations;
– human resources.
The results of applying the Agile method:
– increasing the speed of development and decision-making;
– reducing costs in the management system;
– expanding the possibilities in the innovative activity of the bank.

Source: elaborated by the authors

One of the pioneers of implementing Agile technology in the Republic of Moldova is BC

"Moldova Agroindbank" SA, which in December 2021 announced its intention to undergo an Agile transformation, a project that is expected to lead to long-term organizational and cultural change and bring tangible operational improvements. An agile model of operations is based on a flatter organizational structure, as opposed to the traditional hierarchical one. The organizational transformation will create a new structure and processes, around which smaller and more agile teams will be able to achieve their goals, supported by the bank's "big picture" strategy. The cultural change will place decision-making authority and responsibility for the final result firmly in the hands of people closer to the customers. The desired outcomes of the transformation will be:

- increasing the speed of change execution through a simplified operating model;
- the ability to better respond and adapt to customer needs;
- increasing productivity;
- increasing employee engagement;
- becoming the preferred employer of talent;
- increasing the ability to deliver higher returns to shareholders [5].

On September 6, 2023, maib announced the launch of the full digital onboarding process, available to Moldovan citizens; a significant achievement in simplifying and facilitating access to banking services. Digital onboarding became possible after a series of legislative changes in the country, as well as thanks to the innovative approach adopted by maib in its mobile banking application. Any Moldovan citizen with a national identity card can now open an account with maib without visiting a branch. This process does not require a digital signature, but is replaced by maib's own Facial Identification and Verification functions. The security measures incorporated into the maibank application compare the user's photo and the government database, allowing for automatic know-your-customer (KYC) verification. This solution received approval after a pilot project that started on July 1, 2023. New customers can benefit from the widest range of services offered by the maibank digital application, as well as some of the most advanced security features. maib's digital onboarding process is by far the most advanced, fastest and most convenient on the Moldovan banking and financial market [6].

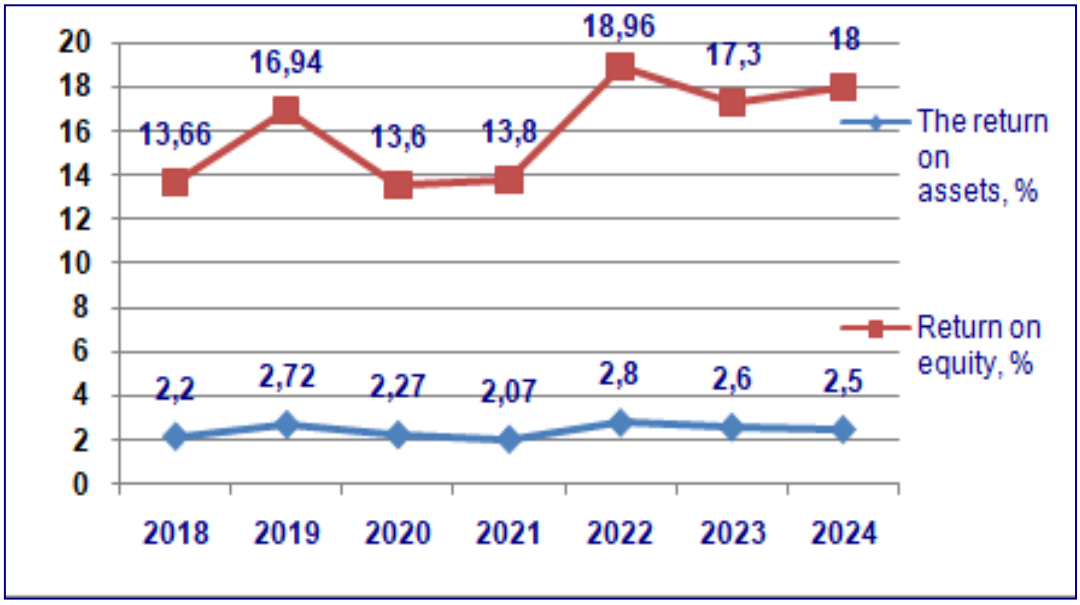
For 2024, the bank continued its development by implementing a dedicated widget that allows customers to organize, manage and plan their loan payments more efficiently, offering a clearer and more predictable experience. Maib is the first bank in the Republic of Moldova to integrate 100% digital insurance, such as Green Card, Travel and MTPL. The possibility of exploring and purchasing insurance through maibank is a new step in the development of the service ecosystem around our mobile application, marking the first step towards a digital insurance platform dedicated to maib customers. Policies are always available in the maibank application through the possibility of adding to digital wallets (Apple/ Google Wallet) [7].

The revolutionary factor in the transformation of the banking industry is the implementation of the Open Banking concept, which involves the use of APIs for integration with external services and the creation of personalized solutions for customers. The plans for 2025 propose the development of the open banking service. Customers will be able to link and manage accounts from multiple banks directly in the maibank application, viewing all financial information in one place. They will also be able to initiate payments without resorting to third-party services, ensuring faster transactions with secure authentication and consent protocols.

This is just one example of the active digitalization of the banking sector and the remodeling of business processes to increase banking performance indicators, as can be seen from the

information included in figure 5.

Figure 5. Dynamics of efficiency indicators reported by BC „Moldova Agroindbank"SA



Source: elaborated by the authors based on the data [11]

The return on assets (ROA), as observed from the data in Figure 5, shows an increase in the years 2018–2019 and 2021–2022, from 2.2% to 2.72% and from 2.07% to 2.8%, respectively, due to an increase not only in net profit but also in the bank's assets. This growth reflects a positive effect resulting from higher income from services other than placements, which carry a higher degree of risk.

The downward trend of this indicator observed during 2019–2021 indicates that the profit center faced difficulties in generating income due to the Covid-19 pandemic and its negative effects, when a considerable portion of net profit was allocated to reserves. For the years 2022–2024, a slight reduction in the bank's reported ROA from 2.8% to 2.5% is noted, in the context of the bank's intensive development.

Return on equity (ROE) evolves similarly to ROA during 2018–2019, with an increase from 13.66% to 16.94%, reflecting growth in net profit. In 2019–2020, it decreases from 16.94% to 13.6%, due to the differing growth rates of equity compared to net profit during the analysed period. For 2020–2022, a steady increase from 13.6% to 18.94% is observed, reflecting the growth of both elements in the calculation formula. In the following two years, ROE initially decreases to 17.3% and then rises again to 18% by the end of 2024, demonstrating that the bank exercises considerable prudence in its operations.

The development prospects of banking business models are linked to the continuous advancement of automation processes and the implementation of fundamentally new technological solutions. Experts predict that by 2030, the majority of standard banking operations will be carried out automatically, with minimal human involvement. Banks will evolve into technological platforms that provide comprehensive digital solutions for managing finances, business processes, and the everyday needs of their clients.

Results

Banks invest in the digitalization of their processes for the following reasons:

- By transitioning to automated business processes, banks begin to achieve higher profits and become more competitive.

- Banks that undergo digital transformation will be able to expand the range of products and services they offer.

- Bank customers will be able to benefit from services related to telecommunications, education, retail, and healthcare.

- The speed of banking operations will increase.

- To attract new customers and retain existing ones.

Based on the analysis of international experience in the digitalization of banking activities, it is necessary to highlight the most promising directions for the use of digital technologies in the financial sector:

a) the application of assets and smart contracts in the lending process. These processes are based on blockchain technology, which allows consideration of both financial and non-financial assets within transactions.

b) storing credit histories using blockchain technologies. Such a practice would enable the exchange of data regarding borrowers' credit histories without the need for intermediaries to obtain and maintain this information.

c) the use of blockchain technologies for handling bank guarantees and trade finance (such as factoring and letters of credit), as well as for interbank interactions at both national and international levels.

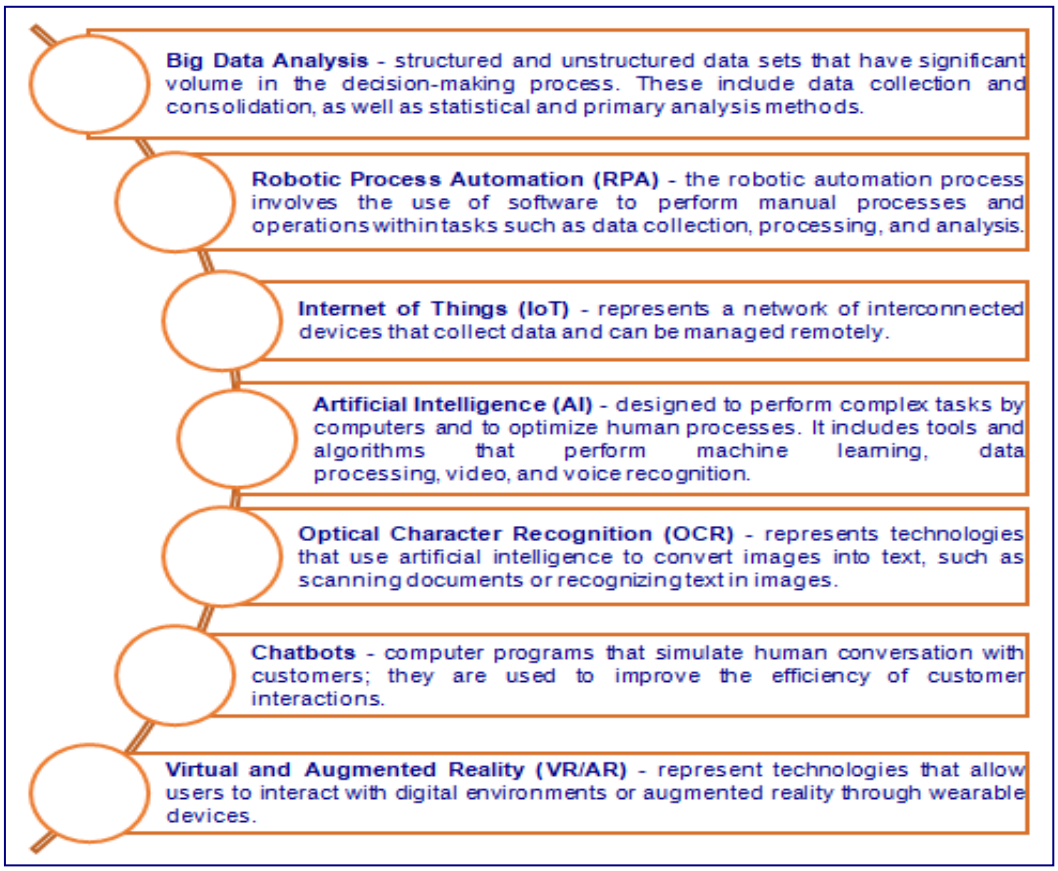
d) the application of digital technologies for operations with bills of exchange. Under current conditions, it is possible to carry out operations with bills of exchange, and electronic documents can be issued in the form of smart contracts. In this system, participants may include the central bank, commercial banks, stock exchanges, and other interested parties.

Digitalization has significant potential to increase the efficiency of all organizations that adopt it; however, this process is also associated with a large number of risks, some of which cannot yet be fully identified or mitigated. It can also be noted that digitalization can substantially contribute to reducing the potential risks of financial activities, due to the use of analytical procedures, information gathering, and the implementation of risk-reduction or prevention measures based on the data obtained.

The big players of the banking sector, in the process of transforming their own business processes, use various modern information technologies (figure 6).

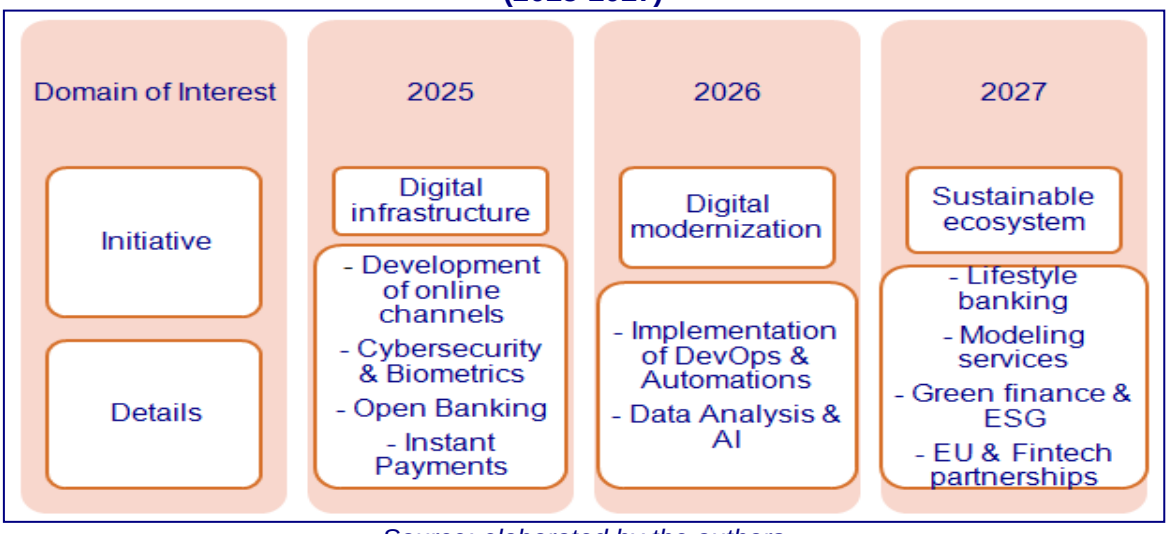
The key direction of business model transformation in the banking industry in recent years has become the formation of its own internal ecosystem, the development of business relationships with other companies, as well as partnerships with IT companies, by creating completely new areas of activity based on the use of cross-cutting technologies, such as blockchain (figure 7).

Figure 6: Technologies implemented by the bank to transform business processes


Big Data Analysis - structured and unstructured data sets that have significant volume in the decision-making process. These include data collection and consolidation, as well as statistical and primary analysis methods.
Robotic Process Automation (RPA) - the robotic automation process involves the use of software to perform manual processes and operations within tasks such as data collection, processing, and analysis.
Internet of Things (IoT) - represents a network of interconnected devices that collect data and can be managed remotely.
Artificial Intelligence (AI) - designed to perform complex tasks by computers and to optimize human processes. It includes tools and algorithms that perform machine learning, data processing, video, and voice recognition.
Optical Character Recognition (OCR) - represents technologies that use artificial intelligence to convert images into text, such as scanning documents or recognizing text in images.
Chatbots - computer programs that simulate human conversation with customers; they are used to improve the efficiency of customer interactions.
Virtual and Augmented Reality (VR/AR) - represent technologies that allow users to interact with digital environments or augmented reality through wearable devices.

Source: elaborated by the authors

Figure 7: The evolution of trends in the banking sector of the Republic of Moldova (2025-2027)



Source: elaborated by the authors

The continuous updating and modernization of online applications, as well as the implementation of new technologies, directly influence the competitiveness of the banking system. Through mobile applications, clients can perform remote operations – they can take out loans, manage accounts, open deposits, obtain certificates, statements, transaction histories, and more. Therefore, the convenience of services and applications significantly affects how clients evaluate the quality of banking services.

Thus, the digitalization of the environment and business processes in the banking sector is characterized by the fact that banking products and services are delivered through digital communication channels. The infrastructure of a modern bank is optimized for real-time digital interactions, and the internal culture assumes a high speed of decision-making and implementation of technological changes.

Conclusions

In conclusion, it is necessary to note that the main factors influencing the modern banking sector are the digitalization of almost all areas of social activity and the financialization of the economy, which represent objective processes of contemporary societal development. These trends are becoming dominant for the banking sector, subsequently determining its direction of development in the future.

The main advantages of implementing information technologies in banking activity are primarily related to:

– the possibility of performing banking operations 24/7;

– the reduction of operational expenses;

– the decrease in the time required to carry out financial operations and provide banking products;

– the increase in calculation accuracy and the reduction of risks related to reporting data distortions;

– the more convenient use of banking products and services;

– the reduction of customer service costs in bank branches;

– the ability to quickly launch banking products and services on the market, as well as to access services through a single interface.

The digital transformation of banking business models in the Republic of Moldova is characterized by a systemic nature of change that affects all aspects of financial institutions' activity — from technological architecture to the principles of customer interaction.

Banks are evolving from traditional financial intermediaries into providers of complex technological ecosystems that integrate a wide range of digital services. The regulatory support provided by the National Bank of Moldova for innovation — including the development and implementation of digital technologies, opens banking systems, and biometric payments — creates favorable conditions for deepening digitalization processes.

The success of this transformation is determined by the banks' ability to comprehensively adapt the technological, organizational, and cultural aspects of their activity to the requirements of the digital economy.

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THE ROLE OF CENTRAL BANKS AND ECONOMIC SUSTAINABILITY IN THE CONTEXT OF THE DIGITAL AGE

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Abstract:

Human history reflects a continuous evolution, initially slow over millennia but significantly accelerated during the Renaissance and modern era. Geography, natural resources, conflicts, and technological progress have shaped societies, generating both material and spiritual achievements. The Industrial Revolution marked a turning point by replacing manual labor with machinery, bringing comfort and prosperity, but also creating environmental imbalances that became more evident in the 20th century. In the 21st century, climate change and global warming represent pressing priorities on the international agenda, with the 2015 Paris Agreement establishing ambitious targets for reducing greenhouse gas emissions and fostering renewable energy development. The objective of this paper is to analyze the strategic role of central banks and financial institutions in promoting sustainable investments, supporting green transition policies, and enhancing public awareness regarding climate-related risks. The methodology combines literature review with comparative analysis of European and Romanian practices, highlighting both achievements and challenges. Preliminary results show that green finance emerges as a fundamental driver of economic resilience, providing tools for redirecting capital flows toward environmentally responsible projects. Romania's commitment to renewable energy targets illustrates the relevance of aligning financial systems with climate objectives, contributing to a cleaner, more inclusive and sustainable future.

Keywords: *green finance, sustainable development, climate change, central banks, renewable energy.*

JEL classification: *Q54, Q01, E58*

Introduction

The global context of sustainability and innovation

In recent decades, the concept of sustainability has become a fundamental benchmark in shaping economic and social development strategies. Climate crises, demographic pressures, and the accelerated consumption of natural resources have prompted a reassessment of the classical growth model based solely on economic expansion. At the

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same time, technological innovation has provided both solutions to reduce the negative impact on the environment and new challenges related to the adaptation of institutions and financial markets to digital transformations.

At the global level, the transition toward a green economy is shaped by major international agreements such as the **2030 Agenda for Sustainable Development** and the **2015 Paris Agreement**, which established clear objectives for reducing greenhouse gas emissions and promoting renewable energy. The **European Union** has positioned itself as a leader in environmental policies through initiatives such as the **European Green Deal** and the **Fit for 55 Package**, aimed at achieving climate neutrality by 2050.

Beyond the ecological dimension, innovation plays a decisive role in ensuring economic sustainability. Emerging technologies such as artificial intelligence, blockchain, and FinTech solutions facilitate access to green financing, improve transparency in ESG reporting, and allow for more accurate monitoring of investment impacts. Social innovation and collaborative governance models also contribute to engaging citizens and the private sector in achieving sustainability goals.

Thus, sustainability and innovation are not parallel directions but interdependent processes that define the current stage of global transformation. In this context, central banks and financial institutions become essential actors, with the capacity to guide capital flows and contribute to balancing economic progress with environmental protection.

The link between technological progress, economic development, and environmental challenges

Technological progress has historically been the main driver of economic development and social transformation. From the agricultural and industrial revolutions to the digital era, each wave of innovation has brought significant benefits in terms of productivity, living standards, and access to goods and services. However, rapid advances have also generated substantial environmental costs, including increased resource exploitation, higher levels of pollution, and the intensification of climate-related phenomena.

Today, the relationship between technological progress and environmental sustainability is ambivalent. On one hand, technology is a source of major risks, such as excessive energy consumption or the generation of new types of waste (e.g., electronic waste). On the other hand, technology is also an indispensable tool for addressing ecological challenges and supporting the transition toward a green economy. Innovations in renewable energy, smart mobility, energy efficiency, and digitalized industrial processes show that technological progress can be oriented toward sustainability.

The contemporary dilemma is not whether innovation can contribute to sustainable development, but **how** it can be managed and regulated to maximize its benefits while minimizing its negative effects. This is where the role of public policies, international cooperation, and, in particular, central banks and financial institutions becomes crucial. Through the instruments they control, they can facilitate access to capital for innovative projects, integrate climate risks into financial stability strategies, and support the orientation of technological progress toward environmentally compatible goals.

The relevance of central banks' role

Central banks have traditionally been perceived as institutions with narrowly defined mandates, limited to ensuring price stability, supervising the banking sector, and safeguarding financial stability. However, in recent decades, the complex nature of global risks—particularly climate and environmental risks—has broadened the debate on their role and responsibilities.

Climate risks manifest both directly in the real economy (natural disasters, infrastructure damage, reduced productivity) and indirectly in the financial sector (rising non-performing loans, declining collateral values, market volatility). In response, central banks have started to develop analytical and operational tools to integrate the climate dimension into their activities. Notable examples include **the ECB's climate stress tests**, **NGFS initiatives**, and ongoing debates on the inclusion of green bonds in asset purchase programs.

Furthermore, central banks play a critical role in promoting **green finance** by setting prudential regulations, encouraging transparency in ESG reporting, and supporting sustainable capital markets. In this way, they can contribute not only to reducing the financial vulnerabilities created by climate change but also to channeling resources toward investments aligned with ecological transition goals.

Therefore, the relevance of central banks in the era of innovation and sustainability stems from their dual responsibility: ensuring short-term financial stability while creating a favorable framework for a long-term balanced transition. This dual mission transforms them into strategic actors in achieving a global balance between economic growth, technological progress, and environmental protection.

Objectives and contribution of the paper

This paper aims to analyze the interaction between economic sustainability and technological innovation, with a central focus on the role of central banks in supporting the global transition toward a balanced development model. Building on the premises established by major international climate agreements and regional initiatives, particularly those of the European Union, the article highlights how monetary and regulatory policies can contribute to environmental goals without compromising financial stability.

The main objectives of the paper are to:

- Provide a **theoretical synthesis** of the connections between sustainability, innovation, and financial stability;
- evaluate the **role of central banks** in integrating climate risks and promoting green finance;
- Analyze, through a comparative approach, the **strategic differences** between various monetary institutions (e.g., ECB, Federal Reserve, NBR) in relation to the green transition;
- Formulate **policy recommendations** for strengthening a balanced transition, with a particular focus on Romania's case.

The contribution of the paper lies in offering an integrated perspective on how innovation and sustainability can be harmonized through financial policies. It also addresses challenges related to incomplete data, insufficiently consolidated reporting standards, and geopolitical tensions that may affect the pace of transition. By doing so, the article adds to the current

body of literature while proposing an analytical framework relevant both for academic research and for policy-making.

Literature Review

Definition of concepts: economic sustainability, green finance, balanced transition

Economic sustainability is defined as the ability of an economy to maintain long-term growth and stability while ensuring the responsible use of resources and the protection of the environment. It goes beyond the ecological dimension by also integrating social and institutional factors, and is closely linked to the broader concept of sustainable development.

Green finance refers to the set of financial products, services, and mechanisms designed to support projects with a positive environmental impact: green loans, green bonds, sustainable investment funds, or ESG-linked derivatives. By directing capital toward investments compatible with the ecological transition, green finance is seen as a catalyst for the structural transformation of economies.

The concept of a **balanced transition** refers to the process of adapting to a green economy in a way that avoids polarization and disproportionate adverse effects. A balanced transition implies maintaining macroeconomic stability, reducing social costs, and ensuring a fair distribution of benefits among countries, economic sectors, and social groups.

Relevant research and reports

Recent literature and institutional reports emphasize the importance of integrating climate risks into financial systems:

- **The European Central Bank (ECB)** has introduced climate stress tests and published detailed reports on credit institutions' exposures to transition and physical risks.
- **The National Bank of Romania (NBR)** has developed the *Climate Risk Monitoring Dashboard* (2024), highlighting local vulnerabilities and the limited integration of ESG risks into banking policies.
- **The Federal Reserve (Fed)** adopts a more restrictive approach, focusing only on the impact of climate risks on financial stability, without direct involvement in climate policies.
- **The Network for Greening the Financial System (NGFS)** brings together more than 130 central banks and supervisory authorities, providing transition scenarios and methodological recommendations for integrating climate risks into macroeconomic models.
- **The Intergovernmental Panel on Climate Change (IPCC)** and the **OECD** provide scientific data and comparative analyses linking climate change to economic performance and public policies.

Academic approaches and debates on the involvement of central banks in the green transition

In the academic literature, two major perspectives can be identified:

- **The narrow perspective**, according to which central banks should maintain their traditional role, limiting themselves to supervising the financial risks associated with climate change. This approach is mainly supported by the monetarist school of thought and by the Federal Reserve, which considers that climate policies fall under the responsibility of governments.
- **The extended perspective**, which advocates for the active involvement of central banks in supporting the green transition through programs for purchasing green assets, directing credit flows, or applying prudential adjustments. This approach is especially promoted by the ECB and the NGFS.

At the same time, academic studies highlight the dilemma of **"green vs. growth"**, namely the tension between achieving climate neutrality objectives and maintaining strong economic growth. In this regard, the concept of a **balanced transition** becomes central to the current debate.

Gaps identified in the literature

Although the literature on green finance and the role of central banks has expanded considerably over the last decade, several gaps persist:

- The lack of homogeneous and comparable data at the international level regarding financial institutions' exposure to climate risks.
- Insufficient standardization of ESG reporting, which limits the ability to evaluate progress.
- Limited analyses focusing on emerging countries, with most studies concentrating on the European Union and the United States.
- The absence of a long-term perspective on the effects of green policies on macroeconomic stability and on the fair distribution of transition costs.

Identifying these gaps justifies the need for further research and analytical frameworks that integrate not only the financial dimension but also the social and technological aspects of the green transition.

Methodology and Data

Research design

The present paper adopts an analytical and comparative approach, based on a documentary review of the specialized literature, institutional reports, and publicly available statistical data. The choice of this methodology is justified by the interdisciplinary nature of the topic, which combines economic, financial, and environmental perspectives. Instead of a traditional empirical study, the research focuses on correlating existing theories with the evidence provided by international institutions, in order to identify how central banks support the green transition.

The comparative analysis aims to highlight the strategic differences among the main central banks (ECB, Fed, NBR), as well as to identify convergences generated by multilateral initiatives, such as those of the NGFS or the European Union.

Methods and techniques

The study adopts a documentary and comparative methodology, drawing upon the analysis of specialized literature, institutional reports (ECB, NBR, Fed, NGFS, IPCC, OECD), and publicly available statistical data. The comparative assessment underscores both the convergences and divergences in the strategies of major central banks with respect to the integration of climate-related risks and the facilitation of the green transition. By aligning the theoretical underpinnings of economic sustainability, green finance, and balanced transition with institutional policy frameworks, the paper provides a comprehensive and integrated perspective on the evolving role of central banks.

Data sources

The data used come from a combination of sources:

- **Institutional reports**: ECB Climate Risk Stress Test Reports, NBR Monitoring Reports on Climate Risks, Federal Reserve Financial Stability Reports, NGFS Climate Scenarios.
- **International documents**: IPCC Assessment Reports, OECD Green Growth Indicators, the Paris Agreement (2015), the EU Green Deal, and the Fit for 55 Package.
- **Academic literature**: articles from specialized journals (*Journal of Sustainable Finance & Investment, Ecological Economics, Journal of Financial Stability*).
- **Financial statistics**: databases from Eurostat, IMF, World Bank, and BIS, providing indicators on green loans, investments in renewable energy, and green bond issuances.

These sources provide a solid framework of secondary data, allowing for a comprehensive overview of the evolution of green finance and the involvement of central banks in supporting a balanced transition.

Limitations

Although the chosen methodology has the advantage of integrating multiple perspectives, several limitations must be acknowledged:

- The lack of homogeneous data at the international level hinders comparability across countries and institutions.
- The accelerated dynamics of policy developments render some conclusions valid only in the short term.
- The secondary nature of the data may restrict the depth of the analysis, as no primary data have been collected directly through empirical research.

Nevertheless, these limitations do not undermine the overall relevance of the conclusions; rather, they open avenues for future research, including the expansion of the empirical basis and the deepening of comparative analyses.

Results

Central banks and climate-related financial risks

Central banks have begun to recognize that climate risks can no longer be treated solely as environmental issues but represent systemic factors for financial stability. These risks are divided into:

- **Transition risks** (related to regulatory, technological, and market changes generated by the shift toward a green economy);
- **Physical risks** (related to extreme weather events and natural disasters).

Example: The European Central Bank (ECB) has implemented Climate Stress Tests for credit institutions, highlighting significant vulnerabilities under adverse climate scenarios. The Federal Reserve, by contrast, has a more limited mandate and focuses only on the impact on financial stability, without actively promoting green transition policies. At the national level, the National Bank of Romania (NBR) has developed a *Climate Risk Monitoring Dashboard* (2024), which reveals the Romanian banking sector's exposure to high-carbon-intensive industries.

Green finance as a driver for sustainability

Green finance is becoming a strategic component in channeling capital toward sustainable investments. The evolution of green bonds and green loans demonstrates the financial system's ability to direct resources to renewable energy, energy efficiency, and ecological infrastructure.

Example: At the European level, green bond issuances have exceeded EUR 500 billion, consolidating the EU's position as a global leader in this field. In Romania, green loans increased by more than 90% in 2024, reaching nearly 3% of total banking exposure, with the main destination being energy-efficient buildings.

This dynamic confirms the hypothesis that green finance is a key driver of the sustainable transition, while also raising challenges related to the standardization of criteria and the transparency of ESG reporting.

The innovation dimension

Technological innovation amplifies the role of green finance through digital instruments and FinTech solutions:

- **blockchain** for the traceability of green bonds,
- **artificial intelligence** for ESG risk assessment,
- **digital platforms** that facilitate SMEs' access to sustainable financing.

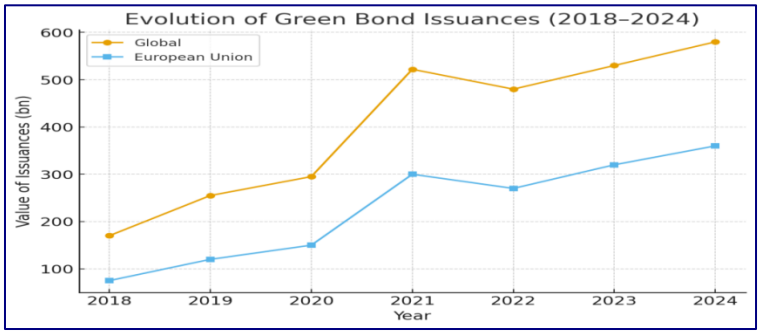
At the same time, digitalization raises issues related to cybersecurity and energy consumption (e.g., cryptocurrency mining), which calls for a balance between progress and environmental responsibility.

Towards a balanced global transition

The green transition is not uniform at the global level. Developed countries have the resources and infrastructure to rapidly implement ecological policies, while emerging economies risk falling behind due to high costs and institutional constraints.

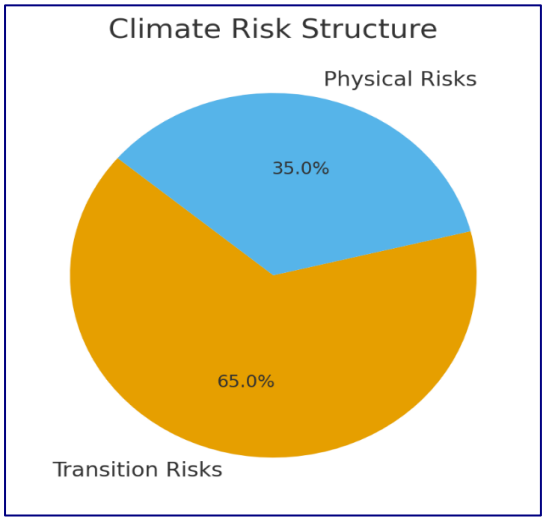
The fundamental dilemma is **"green vs. growth"**: how to maintain economic growth rates without compromising climate objectives. An unbalanced transition could generate geopolitical tensions, economic migration, and widening inequalities. For Romania, participation in the Green Deal and in the EU's renewable energy objectives entails both opportunities (access to European funds, modernization of infrastructure) and challenges (adapting the traditional energy sector, substantial investments in clean technologies).

Figure 1: Evolution of Green Bond Issuances (2018–2024)



Source: Climate Bonds Initiative (2024); European Commission (2023).

Figure 2: Climate Risk Structure



Source: NGFS (2022); IPCC (2022).

Table 1: Comparison of Central Bank Policies

Institution	Climate Stress Tests	Green Asset Purchases	Bank ESG Reporting
ECB	Yes (2022, 2024)	Yes (under PEPP/APP)	Mandatory
Fed	Partial (2023)	No	Voluntary
NBR	Planned (2024)	No	In progress

Source: ECB (2022, 2024); Federal Reserve (2023); BNR (2024); NGFS (2022).

Conclusions and Policy Recommendations

Conclusions

The analysis shows that economic sustainability and innovation are not parallel directions but interdependent processes that define the current stage of global transformation. Central banks, although traditionally focused on price stability and banking supervision, have gradually expanded their scope of action to include climate-related risks and the challenges of the green transition.

The results indicate that:

- **The ECB** is at the forefront of integrating climate risks, through dedicated stress tests and indirect support for green bond markets.
- **The Federal Reserve** takes a more conservative position, limited to the impact on financial stability, without an explicit mandate to support the ecological transition.
- **The National Bank of Romania (NBR)** is in a stage of consolidating its monitoring tools, which creates the opportunity to align with European best practices.

At the same time, the rapid development of the green finance market confirms its role as a driver of sustainability, although challenges remain regarding the standardization and transparency of ESG reporting. Technological innovation accelerates this process but requires adapted regulations to prevent secondary risks (cybersecurity threats, excessive energy consumption).

Overall, the main conclusion is that achieving a **balanced transition** requires close coordination between monetary policies, prudential regulations, and economic development strategies, so that technological progress remains compatible with environmental protection and financial stability.

Policy Recommendations

Based on the analysis, the following policy recommendations can be formulated:

1. **Strengthening the ESG reporting framework** – through common standards and transparency requirements that ensure international comparability of data.
2. **Integrating climate risks into financial stability assessments** – by conducting recurrent climate stress tests and incorporating these risks into macroprudential strategies.

3. **Supporting the development of the green finance market** – through fiscal incentives for green bonds and green loans, as well as by facilitating access for SMEs to sustainable financing.
4. **Promoting responsible innovation** – by adopting digital technologies that enable green financing, while implementing regulations that mitigate risks related to cybersecurity and excessive energy consumption.
5. **Ensuring a balanced global transition** – through international cooperation mechanisms that support emerging economies and reduce the gaps between developed and developing countries.

The implementation of these recommendations would contribute to transforming central banks from exclusively prudential actors into promoters of sustainable development, capable of balancing the requirements of financial stability with the imperatives of environmental protection and technological progress.

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THE IMPACT OF MENTAL ACCOUNTING ON FINANCIAL DECISIONS

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Abstract:

Mental accounting is a concept in which individuals categorize, evaluate, and manage money in various mental accounts without taking into account the fungibility of money. The purpose of this article is to present the methods, consequences and impact of mental accounting on financial decision-making. The study examined expert opinions on the topic that were published on the Internet. Mental accounting refers to the way individuals perceive and categorize their money based on its source and intended purpose. Mental accounting's impact can be categorized as primary and secondary. Individuals divide monetary means into personal and public, owned and borrowed, obtained in a planned and unexpected manner. People tend to focus excessively on one account without considering the full spectrum of financial activities, which is caused by irrational financial decision-making as a secondary impact. Mental accounting manifests itself in various areas of finance, such as personal, corporate, public, and investment. Examining the effects of mental accounting helps to fully explain the dysfunctions of financial mechanisms.

Keywords: *mental accounting, financial decision, money*

JEL classification: *D91; E71; G41*

Introduction

Mental accounting is a concept in behavioral economics that describes how people divide and evaluate economic outcomes based on subjective criteria, leading individuals to sort assets into distinct "accounts", both figuratively and literally (Raymond).

Mental accounting manifests itself when a person assigns different values to the same amount of money based on subjective criteria. (Segal, 2024) This can also manifest itself in human attitudes towards money, when people, instead of treating it as interchangeable, attribute different values to money depending on its source or intended use (Kuhl), (Raymond).

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In this context, the citation of SezenGüngör (2022) is important: „Accounting generally occurs in the forms of recording, classifying, summarizing, reporting and analyzing financial transactions of businesses. It is acceptable for people to need accounting for their own expenses and earnings. However, if this situation only takes place in the mind and turns into invisible journal entries, it will be necessary to mention the mental accounting tendency at this point."

As part of mental accounting, *mental budgeting can be considered a* financial management mindset and is the psychological process of mentally separating income and expenses into different categories or mental accounts to manage spending decisions, rather than relying solely on a physical budget. It involves allocating funds to specific mental budgets for various expense categories, tracking expenses against these budgets, and adjusting behavior when a mental budget is exhausted, as well as making provisions for deferred expenses. Mental budgeting is considered a self-control mechanism, based on pre-commitment to budgets allocated to expense categories. (Antonides, de Groot, 2024)

The main problem with mental accounting is that it creates conditions for irrational financial decision-making, causing people to focus excessively on a single account without considering the full spectrum of financial activities. (Raymond)Different classification of money based on subjective criteriacan, in turn, lead to inefficient financial behavior of people, which may take the form of irrational spending or counterproductive investment decisions. (CFI)

To confirm the importance of mental accounting research, expert James Raymond presents statistical arguments. 80% of professional athletes deplete their wealth within just three years of retiring from sports. 70% of lottery windfall winners end up bankrupt, and the larger the winnings, the more likely they are to go bankrupt.

The purpose of the research was to demonstrate that mental accounting problems are not only related to the direct management of the individual's personal budget, but also extend into broader financial domains, generating important consequences (effects).

Literature Review

The concept of mental accounting was introduced by Richard Thaler in his works by defining it as "a set of cognitive operations used by individuals and households to organize, evaluate, and track financial activities". This author observed that people assign value to money differently, which leads them to make irrational decisions. The concept states that individuals classify money differently, based on subjective criteria, which often causes people to make irrational spending and financially inefficient investment decisions. (Thaler, 1985), (Thaler, 1999)

The psychological aspects of mental accounting have been examined in the work of the research team led by Zhenliang Liu (2017) who demonstrated that consumers mentally differentiate between money and expenses relevant to themselves or others.Also of interest is the research carried out by the team of authors led by Lin Cheng (2023) on the influences of mental accounting on consumption decisions.

The issue of the impact of mental accounting on the investment processwas examined by specialists from the Corporate Finance Institute and authors: Daniel Kuhl, I. Shalika, H. J. R. Buddhika.

The manifestation of the influence of mental accounting in finance was researched by James R. Jr.Hines, Richard H. Thaler (1995), Stephan Muehlbacher, Barbara Hartl, Erich Kirchler

(2017), Johannes Becker (2020), Daniel Nettle, Rebecca Saxe (2020), B. O. Wanas (2024), Thomas F. Epper, Ernst Fehr, Claus ThustrupKreiner, Peer EbbesenSkov (2024)

Regarding the examination of the manifestation of mental accounting in the field of corporate finance, we can present the works of O.M. Anolam, S.N. Okoroafor, O.O. Ajaero (2015) andDan Nicholson (2024).

And the authors Tanaya Das and Sulagna Das (2024) studied the influence of mental accounting on the financial well-being of young adults.

Methodology and Data

The research was based on screening the views of experts in the field of behavioral finance on the phenomenon of mental accounting and its influence on different spheres of financial relations.The accumulated materials were systematized and a synthesis was carried out through the prism of personal finance, investments, public and corporate finance.

Results

The study established the existence of a relationship between mental accounting and other cognitive biases (Pompian, 2019):

Framing bias is a cognitive bias (thinking error) that occurs when a person’s decisions are influenced by the way information is presented, or framed, rather than by the objective facts themselves. "Framing" refers to whether an option is presented as a potential loss (negative) or a potential gain (positive), even if both options lead to the same outcome. Whether the same information is presented in a positive or negative light can lead to different choices because individuals prefer gains over losses. (Nikolopoulou, 2023)

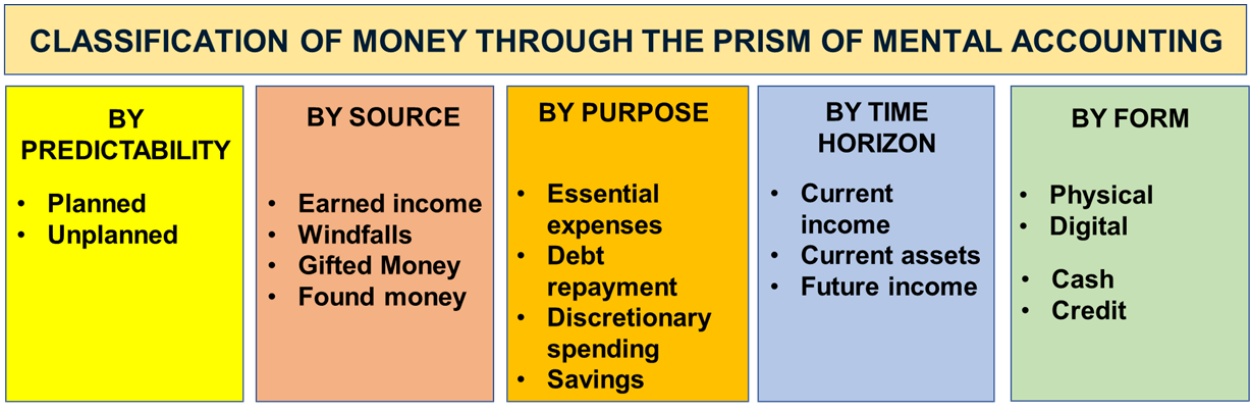
Confirmation bias is a largely unintentional bias related to the tendency of individuals to process information by seeking out or interpreting information that is consistent with their existing beliefs. At the same time, a person ignores information that is inconsistent with their beliefs. Individuals' beliefs in this context can include a person's expectations of a given situation and their predictions about a certain outcome. In other words, this bias reflects the tendency of some individuals to understand and interpret the information they receive in a way that supports their own beliefs, especially when a issue is important or personally relevant to them. (Britannica, 2025)

*Sunk cost fallacy*is the tendency of people to continue an activity or endeavor even when it would be more beneficial to abandon it. Once a person has invested time, energy, or other resources (including money), they believe that it would all have been in vain if they gave up.This reflects the belief that a course of action should not be abandoned because significant resources have already been invested.As a result, the negative results of the inefficient investment decision are exacerbated.(Nikolopoulou, 2024)Mental accounting can lead to the sunk cost error, however it should be noted that the issuerefers to the continuation of an activity due to a previous investment, but not to the mental classification of the money used.

Illusion of control(also known as *illusory control*) is a cognitive bias expressed by the tendency of people to exaggerate their ability to produce a desired outcome, even when those outcomes are largely determined by chance or are entirely uncontrollable.(Baumeister, Vohs) For example, this bias can manifest itself when choosing lottery numbers.

The research found that mental accounting is linked to complex money classification, as shown in Figure 1.

Figure 1: Financial mechanisms of Delayed Life Syndrome



Source: developed by the authors

According to the criterion of predictability, financial resources are divided into two categories:

Planned (or routine) income is obtained in the form of predictable earnings and usually linked to certain economic activities, such as salary. These amounts usually find their place in the family budget to cover current expenses and to form savings for their future use (or to cover financial risks);

*Unplanned (or unexpected) income*refers to money that is not related to current activities, such as lottery winnings, unexpected bonuses, tax refunds, unexpected inheritances, which are often directed towards the purchase of luxury items, financing travel or parties.

Individuals mentally categorize money obtained from various sources, which influences their spending behavior (Kasumi, 2025):

Earned income: This is money received on a regular basis from jobs (paychecks), which in most cases is earned with hard work and is treated with more caution or saved carefully.

Windfalls: Examples of such money are tax refunds, lottery winnings. This money is often understood as found money and is spent more freely.

Gifted money: This is money received, for example in the form of bonuses or gifts, which is usually spent with fewer constraints than earned income.

Additionally, the following categories can be mentioned (Skwara, 2023):

Pride-Tagged Money: Money earned through personal achievements, such as scholarships, which can be spent on meaningful things, such as a gym membership.

Surprise-Tagged Money: Unexpected money, often perceived as a manifestation of luck, such as winning the lottery, which can be used for products that can be shared with others.

Classification of money by purpose of use may include:

*Essential spending*which refers to assuming the daily, unavoidable costs necessary to maintain a basic standard of living, such as paying for housing, food, utilities, healthcare, and transportation.

Debt repayment: These are the funds allocated to make payments related to loans or credit cards.

Discretionary spending refers to optional expenses that are not essential to daily functioning and can be adjusted to fit within a budget. Therefore, individuals can choose to make or reduce them without negatively impacting their basic operating needs. For individuals, these can include costs such as dining out, entertainment, and vacations.

Savings means allocating money to set aside a certain portion of a person's personal income to finance future goals and needs.

The problem of mental accounting largely refers to *inefficient financial decision-making*.

For personal finances, they can manifest themselves in the following ways:

In the case of a tax refund, obtaining a bonus or winning the lottery, money is often used for impulsive purchases, missing the chance to improve the individual's overall financial situation.

The individual's willingness to spend or take risks with unearned money (such as gambling winnings) rather than organizing their personal financial life with regular income.

Prioritizing the use of funds for discretionary expenses over those related to necessities can lead to spending all the money on entertainment and then not having the means to pay the bills.

Keeping money in a low-interest savings account, while simultaneously, resorting to high-interest debt is a financial inefficiency.

According to some specialists, the impact of mental accounting in personal finances can be mitigated through the following measures (Indeed, 2025), (Kuhl), (Mental…, n.d.), (Bajaj Finserv AMC, 2025):

First, it is beneficial to recognize that money is fungible, which means, in particular, that a monetary unit earned from a bonus should be viewed in the same way as money earned from one's own salary.

Further, it is advisable to carry out substantial self-training in the field of financial management.

Then it is necessary to analyze the complete financial picture of personal finances. This can be done on a spreadsheet or within an application to track all cash flows.It would be beneficial to use financial tools that provide a comprehensive picture of total financial resources, rather than focusing on individual mental accounts.

The fourth step is the transition to the development of a formal budget. In order to avoid the biases of mental accounting, the budget must be comprehensive and treat all money as interchangeable, regardless of its source or intended use. The existence of a household budget will prevent the automatic spending of found, donated, or unexpected money, because spending will be made according to established rules, when all money is considered the same. Adherence to the budget will help limit spending, especially on what is perceived as a good deal at the moment.

At the same time, it would be advisable to plan for the use of unexpected income. This plan does not necessarily have to be extremely restrictive, but it is necessary to establish certain rules that help the individual value money equally, regardless of how they get it and the circumstances they find themselves in.Planning for unexpected income, such as bonuses or tax returns, must include adjusting them with the individual's financial priorities, such as paying off high-interest debt.

It is necessary to avoid the temptation to keep money in low-interest savings accounts while resorting to high-interest debt.

In addition to the above, it is possible to seek professional assistance. A financial advisor can provide an objective, third-party perspective on an individual's personal financial situation, helping to support more rational decision-making and develop a comprehensive financial plan.

In the *investment field*, mental accounting may appear as a bias that leads individuals categorize their assets into money they can afford to lose and money they cannot, influencing their risk-taking behavior.(Kuhl)

This mental division leads to decisions to choose between speculative (risky) and safe (conservative) portfolios. (Bajaj Finserv AMC, 2025)

This refers to funds that must be preserved, which are often obtained from regular income (earned through work). Such funds aretypically linked to certain financial goals in the future and are vitally important for the personal or family budget. These are usually placed in financial instruments with a low level of risk, but also with a relatively modest return.

In contrast, additional money (unexpected, unplanned), which investors believe they can afford to lose, is placed in uncertain and speculative financial instruments, therefore with high risk and with the hope of high gains. (CFI)

According to experts from the Corporate Finance Institute, this distinction represents a mental illusion. From a financial management perspective, this is a case of poor mental accounting, as all money is the same and there can be no decision that justifies losing the money held. (CFI)

To mitigate the effects of mental accounting in investment activity, the following recommendations can be made:

•It is necessary to correlate assets with the objectives of the investment activity. When making investments or forming savings, it is necessary to base decisions on the timeline of objectives and the level of risk, rather than on the initial source of the money.

•Periodic rebalancing is beneficial. Even if the money is in separate funds, it is necessary to review the total portfolio every 6-12 months to ensure that the allocation of funds is still on a balanced trajectory.

•It is necessary to avoid emotional labeling. Individuals are advised not to treat money received from gifts, bonuses, or inheritances differently from their regular income.

•It is possible to use specialized programmed applications. These tools help to plan regular investments and withdrawals across the entire portfolio.

The manifestation of mental accountingin *public finance*, in the opinion of the group of authors led by Johannes Becker (2020), has the following features:

People can mentally differentiate public funds from private funds, with specific allocations being assigned to public goods, while private funds are intended for personal consumption.

The flypaper effect, which is a concept in public finance,suggests that a government subsidy to a recipient local government increases the level of local public spending more than an increase in local income of an equivalent size.(Hines, Thaler, 1995) Studies show that public funds can have a greater impact on public spending because they are mentally perceived as belonging to a "common account", influencing how voters demand redistribution from them.

The perceived fungibility (exchangeability) of public money may be limited in public opinion, leading to preferences regarding how these funds are spent.

In terms of the perception of public money by members of society, we can highlight the following aspects:

When taxes are collected, taxpayers may not immediately think of this money as a reduction in their personal wealth, but rather as funds flowing into a separate "public funds" account.

Voters may be more willing to support government spending from an unexpected amount of public money (for example, from external financial support) than if the same amount came from new taxes or private revenues.

Mental accounting can lead to a strong positive correlation between the classification of government spending and its rationalization, suggesting that it impacts how people perceive and justify government spending. (Wanas, 2024)

Mental accounting in public finance influences the willingness to fund programs by causing individuals and policymakers to classify funds differently based on their source and intended use, rather than treating all money as fungible. This bias can make public funds appear free or tied to specific uses, increasing the willingness to fund programs from a large public pool, compared to a private one. Policymakers can capitalize on this by designing programs that fit mental accounting behaviors, for example, by tying funding sources to specific objectives or by framing benefits to influence public support. The way public funds are framed can affect people’s willingness to fund public programs. (The Decision Lab)

Mental accounting impacts support for public policies. A larger public fund may lead to greater demands for redistribution, especially from low-income voters, demonstrating a link between mental accounts and support for public policies.

Some studies link mental accounting to inequality aversion. Individuals often have an aversion to seeing large disparities in wealth or income. When a public fund is larger, low-income individuals may perceive this as an opportunity to reduce inequality by advocating for greater redistribution. Their mental accounting may perceive this fund as available for redistribution to those in need. (Epper et. al., 2024), (Nettle, Saxe, 2020)

In the examined context, the mental framing of accounts can be mentioned. The way in which public funds are framed can influence how people perceive them. If a fund is labeled as emergency support (aid), it could be more easily allocated to specific needs than a general fund. This framing can shape voters' mental accounts and their support for specific policies. (Muehlbacher et. al., 2017), (Nettle, Saxe, 2020)

Mental accounting can influence how individuals perceive the value of public money. Mental separation makes individuals less likely to view public services (financed by taxes) as expensive because the cost is not paid directly from their personal spending account. These

funds are seen as coming from a government spending account. Thus, public services financed by general taxes may appear less expensive because their cost does not come directly from an individual's personal budget, such as money for shopping or vacation funds. This mental accounting can lead to a systematic bias, in which people are less likely to recognize the true financial burden of public services on their general finances, which can lead to less critical involvement in public spending and policy decisions.

One aspect of the manifestation of mental accounting in public finance is anchoring.In this case, the size of the common public account can act as an anchor, and people's decisions are influenced by it, rather than by the objective merits of the situation. Individuals are often inclined to support larger transfers under the influence of the availability of a larger public fund, even without individual mental accounting. (Becker et. al., 2020)

Mental accounting can have an influence in the field of *corporate finance* in the following ways:

In the area of corporate investment activity, a company might be reluctant to use funds from a general operating account for a project, considering that financing from a specialized research and development fund would be more appropriate, even if the latter is less profitable. (Nicholson, 2024)Similarly, the sunk cost fallacy can manifest itself in corporate investment. Businesspeople may continue to invest in a failed project because of previous mental investments, instead of cutting their losses based on present value.Companies may also be driven to prioritize funding projects within a set budget category, even if there are better investment opportunities elsewhere.

Mental accounting may be linked to loss aversion. Managers may exhibit greater loss aversion for certain mental accounts (such as those reserved for capital projects) than for others, creating cognitive biases that steer them away from rational choices.

In considering opportunity costs, a company might focus excessively on a single account, neglecting to consider whether that money could be better used elsewhere in the company.

In the area of budgeting and resource allocation, managers may be reluctant to reallocate funds between different mental accounts (e.g., different project budgets), even if such reallocation would be financially optimal for the company as a whole.

Mental accounting can manifest itself in corporate budgeting as follows:

Companies often create budgets by mentally categorizing funds into different accounts, such as those designated for research and development, operating expenses, or marketing.

Instead of treating all available funds as interchangeable (fungible), company managers may perceive money from different sources as having different perceived values or purposes, such as viewing bonus money as discretionary and harder to save.

When mental accounts are kept separate, decisions about spending or allocating resources from a single account may not take into account the larger financial picture or the overall health of the company.

There are possible situations where one department of the company might face financial difficulties, while another department has surplus funds, but the surplus is not transferred because it is in another mental account.

Mental accounts can also contribute to inflexible budgets, making it more difficult for companies to adjust their financial strategies in response to changing market conditions or unexpected opportunities.

When it comes to strategic and tactical spending, a company might spend too much from a discretionary or mental account of "fun" money on a non-essential project, while restricting expenditurefrom another account intended for essential operations, creating an illogical spending pattern.

Mitigating mental accounting in corporate finance is possible in the following ways:

Encourage managers to view corporate finances from a unified, financial results perspective, rather than focusing on individual, separate budgets.

Focus on a view of all corporate funds as interchangeable and fungible, as well as on overall financial health and potential returns, rather than on arbitrary internal categories.

Use effective central financial controls to ensure that resources are allocated based on overall strategic priorities and not just department-specific mental accounting.

Implement flexible budgeting methods that allow for easier reallocation of funds between departments or projects when circumstances change.

Focus on using objective financial data to guide resource allocation, rather than relying solely on the perceived purpose or source of funds.

Apply tools that provide a complete overview of the company's financial position, making it easier to view the entire financial picture, rather than isolated accounts.

Conclusions

Mental accounting represents a specific cognitive process and constitutes an important area of study within behavioral finance. Essentially, it is a behavioral bias related to the fact that some people attribute different values to money depending on its source or intended use.Mental accounting is linked to a complex system of perceiving and evaluating money based on various criteria. When mental accounting turns into an obsessive behavior, it may serve as a major contributing factor to personal financial difficulties. Likewise, the phenomenon of mental accounting is increasingly observed in the spheres of investment, public, and corporate finance.

Since mental accounting has been studied relatively extensively to this day, various measures have been developed to mitigate its negative impact.It is also advisable to integrate them into financial education programs.

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TRANSFORMING THE FINANCIAL ECOSYSTEM THROUGH INNOVATION: INNOVATIVE FINANCIAL INSTRUMENTS, DIGITAL FINANCE, AND OPEN FINANCE IN THE ERA OF DIGITALIZATION

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Abstract:

This paper explores the transformative impact of innovative financial instruments, digital finance, and open finance on the resilience and inclusiveness of modern financial ecosystems. The main objective is to assess how digital innovation supports systemic stability and financial accessibility, particularly in vulnerable or underserved regions. A mixed-methods approach is employed, combining qualitative analysis of policy and regulatory frameworks with quantitative assessment of fintech adoption rates, financial inclusion indicators, and economic resilience metrics. Case studies from both developed and emerging economies are analyzed to identify how open finance tools—such as mobile payments, API-based platforms, and digital identity solutions—enhanceability adapt in times of crisis. Preliminary results show that countries fostering inclusive financial innovation through regulatory flexibility, public-private partnerships, and open banking initiatives tend to demonstrate stronger financial resilience and improved access for marginalized populations. The findings underline the potential of digital finance as a structural mechanism for achieving long-term economic stability and inclusive growth.

Keywords: *digital finance, financial innovation, open finance, financial inclusion, economic resilience*

JEL classification: *G21, O33, E*

Introduction

The accelerated transformations generated by digitalization have produced major changes in the architecture of the global financial ecosystem. The emergence of innovative financial instruments, digital finance and the concept of open finance is redefining not only the way in which value and capital are intermediated, but also the ability of the financial system to respond to external shocks and to include previously marginalized social categories (Zetzsche et al., 2020). These transformations are supported by trends such as the expansion of fintechs, the use of technologies based on artificial intelligence and blockchain, as well as regulations aimed at stimulating competition and increasing transparency (Arner, Barberis & Buckley, 2017).

Central to this process is digital finance, which includes a wide range of services, from

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mobile payments and API-based platforms to digital identity solutions. They facilitate both financial inclusion and economic resilience, especially in vulnerable or underserved regions (Ozili, 2018). For example, the expansion of mobile payments in sub-Saharan Africa has demonstrated how financial innovation can support economic growth and macroeconomic stability, while also contributing to reducing inequalities (Suri & Jack, 2016).

The concept of open finance extends the principles of open banking, emphasizing interoperability, data sharing, and the development of personalized services through collaboration between traditional financial institutions and non-banking actors (European Banking Authority, 2022). In this context, regulatory flexibility and public-private partnerships become key factors in supporting adoption and promoting inclusive innovations (World Bank, 2022).

The objective of this paper is to analyze how these developments contribute to the resilience and inclusion of the contemporary financial ecosystem. Through a mixed qualitative and quantitative approach, we aim to assess both policies and regulatory frameworks, as well as indicators of financial inclusion and economic resilience, in order to identify good practices and successful models. Thus, the introduction establishes the general framework of the research and its relevance in a context characterized by economic volatility, rapid technological change and the need for sustainable solutions for development.

Literature Review

The literature review aims to provide a comprehensive framework of existing research on innovative financial instruments, digital finance and open finance, focusing on two central themes: (1) the impact of digital innovation on financial inclusion and (2) the role of this innovation in systemic resilience in the face of multi-crisis in the current context. Furthermore, we will organize the literature along thematic directions (technologies and instruments; effects on inclusion; regulatory frameworks; digital identity; empirical evidence on resilience) and identify methodological and conceptual gaps.

Defining concepts and evolving terminology

The terms “fintech”, “digital finance” and “open finance” are frequently used, but with slightly variable definitions. “Fintech” encompasses technological innovations applied to financial services, including digital payments, alternative lending, digital insurance and robo-advisors (Arner, Barberis & Buckley, 2017). “Open finance” extends the notions of open banking when it includes the exchange of financial data between multiple entities and the creation of interoperable ecosystems through APIs (Cambridge Centre for Alternative Finance, 2024). The specification of these definitions is important for the comparability of studies (Iman, 2020), as well as for the personal desire to contribute to the completion of these definitions based on the analyses of the specialized scientific literature, as well as on the basis of personal academic and applied experience.

Financial innovations and digital tools

The literature describes a series of tools and technologies with major impact: mobile payments, API-based platforms, peer-to-peer lending, digital identity solutions and tokenization/distributed ledgers (Iman, 2020; Arner et al., 2017). Conceptual studies emphasize that innovation is not only technological, but also organizational, and that they allow the inclusion of new actors (big tech, neo-banks) and data sharing models (Anagnostopoulos, 2018). Critical analyses, however, warn of risks: cybersecurity, data privacy and new counterparty risks.

Digital finance and financial inclusion (empirical evidence)

A rich empirical literature shows positive effects of digital tools on inclusion. The classic study of mobile money services in Kenya (Suri & Jack, 2016) indicates significant increases in long-term consumption and poverty reduction for certain segments of the population. Cross-country reviews and studies (Ozili, 2018; World Bank, various reports) conclude that digital payments and digital microfinance services increase access to financial services, but the effects vary by infrastructure, regulation, and financial literacy *(* Manta O., 2025). A repeated finding is that the impact is stronger where there is interoperability and pro-active inclusion policies.

Open finance, interoperability and APIs

Recent literature treats open banking as a first step towards a broader "open finance". The CCAF (Cambridge Centre) report from 2024 provides a synthesis of global implementations and shows that accelerating adoption depends on regulatory frameworks, consumer trust and the availability of standardized APIs (Cambridge Centre for Alternative Finance, 2024). Emerging econometric studies show how access to data (via APIs) reduces the costs of risk assessment and facilitates the entry of fintechs into the market; however, there are also concerns about data protection and the sophistication of fraud (Babina et al., 2025).

Digital identity and recognized mechanisms such as KYC (Know Your Customer). The implementation of digital identity is treated as a major "enabler" for inclusion, namely allowing fast on-boarding, reducing verification costs and facilitating access to financial accounts (World Bank ID4D; FATF guidance on digital identity, 2020). World Bank documents on ID4D emphasize the role of well-designed digital identities in reducing barriers for women and marginalized groups, but warn of the risks regarding data protection and the exclusion of those without access to technology (World Bank ID4D; FATF, 2020).

Regulation, regtech and systemic stability

Some of the literature focuses on how regulations can promote or hinder inclusive innovation. Arner et al. (2017) and subsequent works (Anagnostopoulos, 2018; Allen et al., 2021) present the role of RegTech for real-time supervision and risk management. On the other hand, works on financial stability warn that digitalization can amplify pro-cyclical risks (e.g. synchronized algorithmic decisions) if there are no adequate safeguards (Ozili, 2018). Recent financial policy changes (at European and global levels), including disputes over "open banking" regulation in some jurisdictions, show us that the regulatory environment remains volatile (government and press sources) and that the balance between innovation and consumer protection is still considered at the level of debate.

Digital finance and resilience in times of crisis

The empirical literature on how digital tools enhance macro/meso resilience is growing. Case studies show that ecosystems with digital payments and digital identification infrastructures have responded more quickly in distributing social assistance in crisis situations (World Bank reports and national assessments). However, the evidence is fragmented, with many studies focusing on particular cases (e.g. Kenya for mobile money) and a rigorous cross-country comparative assessment that controls for institutional and macroeconomic variables is lacking *(* Manta O., 2025).

Gaps, inconsistencies and methodological limitations in the literature

Based on the thematic review, we identify the main gaps, namely:

- ✓ *Lack of comparable studies on resilience at the level of several countries* **,** namely

there are many case studies (Kenya, certain European countries, etc.), but few multi-jurisdictional econometric analyses that isolate the effect of digital instruments on macroeconomic resilience.

- ✓ *The heterogeneity of "inclusion" and "resilience" measures,* namelyindicators vary from study to study (bank accounts vs. active use; macro vs. micro level shocks), which makes meta-analysis difficult.
- ✓ *Unequally distributed effects* **,** where many papers note different effects by gender, age, rural/urban area, but there are few studies investigating the exact mechanisms (e.g., social barriers vs. infrastructure).
- ✓ *Under-quantified emerging risks* **,** such as cybersecurity, operational risks, and the impact of algorithms (bias), are mentioned in the literature, but are not systematically quantified on a large scale.
- ✓ *Regulation-technology interaction* **,** namely, although there are conceptual analyses (RegTech), empirical studies showing how different regulatory frameworks (from permissive to restrictive) influence adoption and socio-economic outcomes are lacking.

Based on the above gaps, this paper proposes: (1) a mixed approach (quantitative + qualitative) to compare fintech adoption and inclusion/resilience indicators between developed and emerging countries; (2) assessing the role of institutional complements (digital identity, standardized APIs, public-private partnerships); (3) examining how regulatory flexibility ultimately influences access for marginalized populations. This will contribute to the existing literature by providing a comparative framework and identifying mechanisms that link digital innovation to public policy outcomes.

The literature review shows a relative consensus on the potential of digital finance and open finance to increase inclusion and improve resilience, but the empirical evidence is partly fragmented and dependent on the institutional context. The following chapters of the paper will attempt to address the identified gaps, combining policy/regulatory analysis with comparative empirical tests and case studies that elucidate the mechanisms through which digital tools affect vulnerable populations.

Methodology and Data

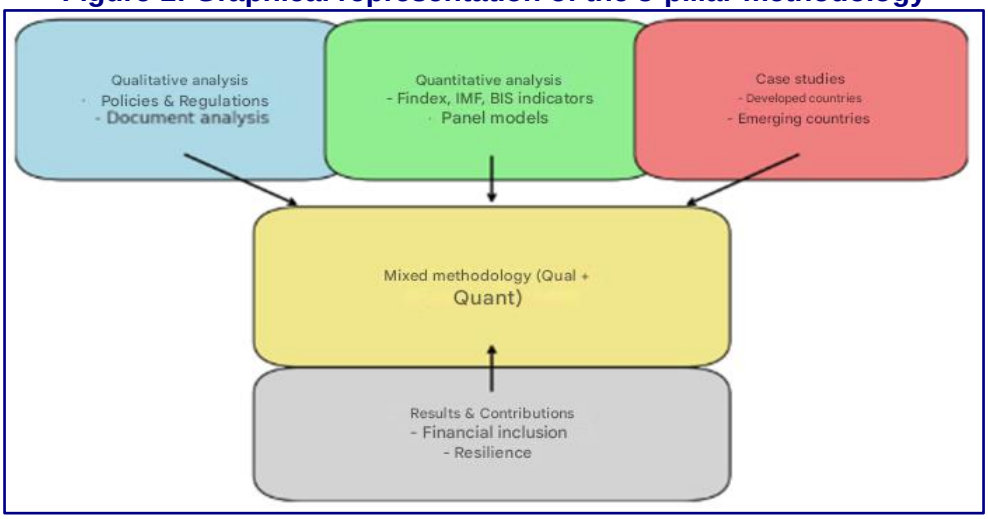
The paper adopts a *mixed-methods design* to capture both qualitative (analysis of the institutional and regulatory framework) and quantitative (analysis of indicators of fintech adoption, financial inclusion, and economic resilience) dimensions. This approach is justified by the multidimensional nature of financial innovation, which involves not only technological transformations, but also policy and behavioral changes (Creswell & Plano Clark, 2017).

The proposed research methodology is based on three pillars:

- ✓ *Qualitative analysis*, namely the evaluation of public policies and regulatory frameworks regarding "open finance" and "digital finance", through comparative analysis of official documents and institutional reports.
- ✓ *Quantitative analysis*, namely the use of statistical indicators regarding financial inclusion, the degree of fintech penetration and economic resilience indicators.
- ✓ *Case studies*, namely the selection of developed and emerging countries to illustrate

differences in outcomes depending on digital and regulatory infrastructure.

Figure 1: Graphical representation of the 3-pillar methodology



Source: authors' own processing

Data Sources

The data used comes from multiple sources to ensure robustness and triangulation, such as:*macroeconomic and financial inclusion indicators* , namely *Global Findex Database* (World Bank, 2021), *IMF Financial Access Survey* , *World Bank Development Indicators* ; *data on fintech and open finance* , namely *Cambridge Centre for Alternative Finance Global Survey* (2024), OECD and BIS reports on fintech adoption; *resilience indicators* , namely data on macroeconomic stability (real GDP, growth volatility, inflation, external shocks) and banking sector stability (BIS, IMF reports); and last but not least *qualitative sources* , namely policy documents (e.g. *EU Digital Finance Strategy* , *FATF Guidance on Digital Identity*), World Bank ID4D reports and national regulations on open banking.

Regarding the sample used in the study, it includes approximately 20 countries, divided into two categories:

- ✓ *developed countries* (e.g. UK, Germany, USA, Singapore) – characterized by mature open banking/finance markets, consolidated digital infrastructures and advanced regulations.
- ✓ *emerging and developing countries* (e.g. Kenya, Nigeria, India, Brazil, Indonesia) – known for bottom-up innovations (e.g. mobile money), but with institutional and regulatory challenges.

The selection was made through criteria of geographical diversity, degree of fintech penetration and data accessibility.

Regarding the data collected and processed in the study, they were structured into:

- ✓ *quantitative data* , namely these were extracted from the aforementioned databases (World Bank, IMF, BIS), with time series 2011–2022 to capture developments before and after recent crises (e.g. the COVID-19 pandemic).
- ✓ *qualitative data* , which were collected through content analysis of official documents and policy reports, using thematic coding methods (Bowen, 2009).

The data analysis in the study is structured as follows:

- ✓ *descriptive and comparative analysis* , in which we have the distribution of inclusion indicators (financial accounts, use of digital payments), fintech adoption (volume of digital transactions, number of fintech users) and resilience indicators (GDP volatility, shock absorption capacity).
- ✓ *econometric analysis* , namely panel models to evaluate the correlation between fintech/open finance adoption and inclusion and resilience indicators, controlling for macroeconomic factors (GDP/capita, urbanization, digital infrastructure).
- ✓ *qualitative analysis* , namely the coding and thematic analysis of policies and regulations, to identify successful patterns (e.g. flexible regulations, public-private partnerships).

The methodology has several limitations. First, the inclusion and resilience indicators differ across sources, which may affect comparability. Second, much of the open finance data is recent and incomplete, which limits longitudinal analysis. Finally, the case studies may be affected by selection bias, as they focus on countries with high visibility in international reports.

The data used are public and do not involve sensitive individual data. However, in the qualitative analysis of policy documents, accuracy of interpretation and transparency of source citation will be ensured.

Results

This section presents the main findings from the quantitative and qualitative analysis. The results are organized around three central dimensions: (1) financial inclusion, (2) adoption of fintech and open finance solutions, and (3) economic and institutional resilience. Tables and figures are included to illustrate the relationships identified.

Trends in financial inclusion

Analysis of *Global Findex* and *IMF Financial Access Survey data* indicates a consistent increase in financial inclusion in both groups of countries (developed and emerging) during the period 2011–2021. Accordingly, *emerging countries* have seen the fastest progress, especially through mobile money services (e.g. Kenya, Bangladesh). And, within *developed countries* , thesethey started from high levels of inclusion, but experienced marginal increases in digital access (e.g. online accounts, electronic payments).

Table 1: Evolution of financial accounts (% of adult population)

Country / Group	2011	2017	2021	Difference (%)
Kenya	42	73	84	+42
India	35	80	78	+43
Brazil	55	70	84	+29
Germany	97	99	99	+2
US	93	95	96	+3

Source: authors' own processing based on Global Findex data and IMF Financial Access Survey

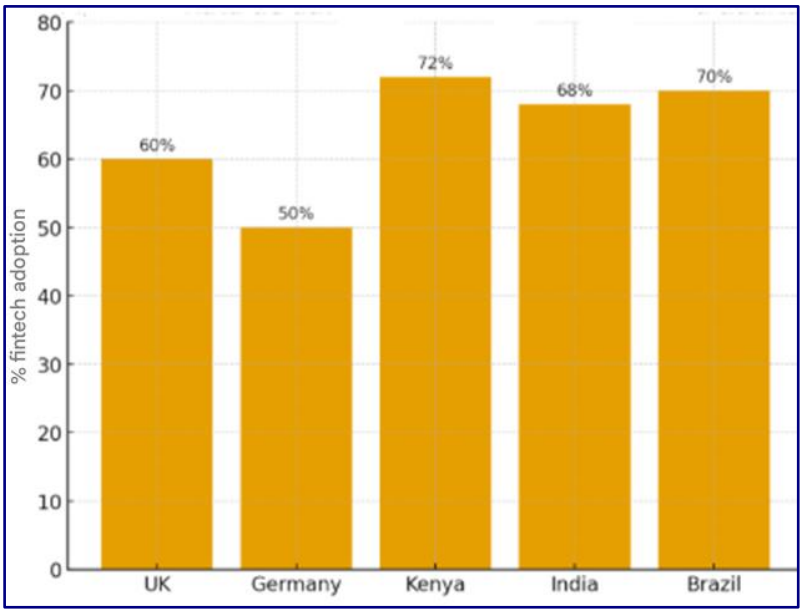
The data in Table 1 highlights a highly differentiated dynamics of the evolution of financial

accounts at the global level. Emerging countries, such as Kenya (+42%) and India (+43%), recorded spectacular increases between 2011 and 2021, due to the expansion of mobile money solutions and government digital banking programs, which significantly reduced financial exclusion. Brazil followed a similar path, with an increase of +29%, reflecting the success of the combination of favorable regulations and fintech innovations. In contrast, developed countries, such as Germany and the US, recorded marginal increases (+2% and +3%), as the level of banking was already almost universal in 2011. These differences confirm that the most visible progress in financial inclusion through digitalization is manifested in emerging economies, where innovative solutions are rapidly filling the gap in traditional financial infrastructures.

Adoption of "Fintech" and "Open Finance"

CCAF and BIS data confirm the acceleration of fintech adoption, especially after 2020, respectively, in *developed countries* , the adoption of open banking and open finance services was stimulated by proactive regulations (e.g. PSD2 in the EU, Open Banking UK), and in *emerging countries* , growth was based more on private innovations (mobile money, local fintechs), sometimes supported by public-private partnerships.

Figure 2: Fintech adoption rate (% of adult population, selective)



Source: authors' own processing based on Global Findex data and IMF Financial Access Survey

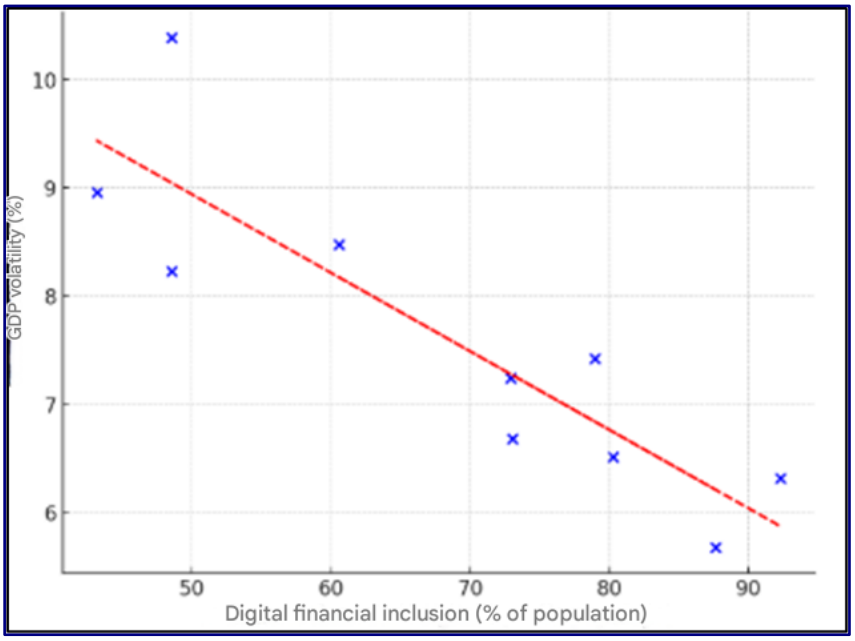
The data presented in Figure 2 highlights significant differences in the adoption rate of fintech services across the countries analyzed. Emerging countries such as Kenya (72%), India (68%) and Brazil (70%) record higher levels of use compared to developed countries such as the United Kingdom (60%) and Germany (50%). This result reflects the fact that, in emerging economies, fintech responds to structural needs unmet by traditional banking systems, offering solutions for fast and convenient access to payments and credit. In contrast, in developed countries, where the level of bankability was already high, fintech adoption has a more complementary character, integrating into a stable but more rigid financial ecosystem. This trend suggests that digital finance has the greatest transformative

impact in regions where traditional financial infrastructure is deficient, demonstrating its potential to stimulate economic inclusion and resilience.

Economic and financial resilience

The results of the panel models suggest a positive correlation between digital inclusion indicators and economic resilience measures.Therefore,Countries with high levels of digital financial inclusion experienced *lower GDP volatility* during the COVID-19 period.Moreover, there is evidence that implementing digital identity and open APIs contributes to more efficient distribution of social assistance in times of crisis.However, the effects are heterogeneous, namely in some emerging countries, the lack of stable digital infrastructure has limited the benefits.

Figure 3: Relationship between digital financial inclusion and GDP volatility (2011–2021)



Source: authors' own processing based on Global Findex data and IMF Financial Access Survey

Figure 3 illustrates the relationship between digital financial inclusion and GDP volatility over the period 2011–2021, presented as a scatter plot with a regression line. A clear negative trend is observed, namely as the percentage of the population with access to digital financial services increases, GDP volatility tends to decrease. This suggests that higher digital financial inclusion could contribute to economic stability, reducing GDP fluctuations and providing greater resilience to economic shocks. The visual evidence of the red regression line reinforces this negative correlation, indicating an inversely proportional relationship between the two variables.

Insights from case studies

Qualitative policy analysis revealed that in the UK and EU, the regulatory framework for “open banking” has fostered a competitive ecosystem, but interoperability issues persist between providers. In Kenya (M-Pesa), the bottom-up innovation model has strengthened household resilience to economic shocks, reducing poverty by ~2% in the long term. And in India (Aadhaar + UPI), the combination of digital identity and instant payments has

accelerated bankability, but raised concerns about data privacy.

Therefore, according to the studies mentioned above, as well as the data presented, it results that digital financial inclusion has increased substantially in emerging countries, reducing historical gaps (Manta Otilia, 2018). The adoption of fintech and open finance is correlated with the flexibility of regulations and the existence of public-private partnerships. Moreover, economic resilience is more pronounced in countries that have invested in digital infrastructure and implemented digital identities on a large scale.

However, we must mention that disparities persist between social groups (gender, rural/urban), and access to infrastructure remains a determinant of results.

Although the analyses highlight clear relationships, the results must be interpreted with caution, as the relationships identified are largely correlational, not causal, the data on open finance are recent and fragmented, and institutional differences between countries make it difficult to generalize the results and have uniform access to this data.

Conclusions

This paper analyzed the role of innovative financial instruments, digital finance and open finance in transforming the contemporary financial ecosystem. The results obtained through a mixed approach (qualitative and quantitative analysis) highlight the fact that *financial inclusion* has increased substantially in emerging countries, especially through the expansion of mobile money services and the implementation of digital infrastructures (e.g. digital identity, instant payments). Moreover, *the adoption of fintech and open finance* is correlated with regulatory flexibility, API standardization and public-private partnerships, which favor innovation and competition *(* Manta O., 2025). *Economic resilience* has proven higher in countries where digital instruments have been widely implemented, allowing for the rapid distribution of resources and more efficient absorption of external shocks.

However, disparities persist *between social groups and between countries* , which highlights the critical role of digital infrastructure and financial literacy.

Scientific and applied contributions of the study results

The results have important implications for theory and practice. *At the theoretical level* , the paper contributes to the literature on the link between digital innovation and financial stability, providing comparative evidence that complements isolated case studies. *At the public policy level* , the findings suggest that flexible regulations, combined with consumer protection mechanisms, stimulate adoption and increase the resilience of financial systems. And, for *the private sector* , the results indicate that interoperability and user trust are key factors in the success of open finance business models.

Study limitations

The study presents several limitations that must be acknowledged, such as *incomplete data* on open finance and fintech in certain jurisdictions, which limits international comparability; *predominantly correlational results* , which do not allow for the clear establishment of causal relationships; and last but not least, *the focus of the studies on a small sample* of countries, which may not fully capture the diversity of experiences at a global level.

Directions for future research

To advance knowledge in this field, future research should focus on developing *scientific analyses.*larger, capturing developments over time and testing causal relationships and

exploring in detail *the social dimension of digital financial inclusion (* Manta O., 2025), with a focus on gender, rural/urban areas and vulnerable groups. Furthermore, we believe that future research should examine *emerging risks* associated with open finance, such as cybersecurity, data misuse and algorithmic effects. At the same time, we aim to extend the research to *new regions and contexts* (Latin America, Southeast Asia, Francophone Africa), in order to better understand institutional variations, especially since Latin America has been a promoter of "digital payments" since 2020.

Policy recommendations

Based on the analyses conducted and the main findings, several policy recommendations can be formulated for decision-makers, financial institutions and private sector partners, namely:

- ✓ *strengthening flexible and inclusive regulatory frameworks,* i.e. regulators should promote *adaptive regulatory frameworks* that support innovation without compromising financial stability.Implementing *regulatory sandboxes* **(** controlled testing areas for fintech) can accelerate the development of safe and inclusive solutions.
- ✓ *Promoting interoperability and open standards* **,** by creating *common API standards* at national and regional levels, is essential for interoperability between financial institutions, fintechs and other actors.We believe that the authorities should collaborate with international bodies (BIS, OECD, ISO) to avoid market fragmentation.
- ✓ *investments in digital infrastructure and digital identity* **,** and governments and multilateral institutions should prioritize *universal access to the internet and digital infrastructure* , especially in rural environments and vulnerable regions.
- ✓ *secure and inclusive digital identity* systems (such as Aadhaar in India) can facilitate access to financial services for undocumented populations.
- ✓ *Improving financial and digital literacy through digital financial education programs* should be integrated into schools, communities and public campaigns, to increase user confidence and skills, and a greater focus should be placed on *women, youth and marginalized groups* , to reduce existing gaps in access to digital financial services.
- ✓ *Strengthening cybersecurity and data protection* **,** namely the development of robust cybersecurity frameworks and clear regulations on the protection of personal data, is crucial for increasing user trust.We believe that cooperation between authorities, financial institutions, and technology companies is recommended to develop rapid response mechanisms to cyber incidents.
- ✓ *promoting public-private partnerships* **,** we believe that governments should actively collaborate with fintechs, banks and non-governmental organizations to develop innovative solutions, adapted to local needs.Furthermore, *digital financial inclusion programs* can be accelerated through co-financing and sharing of expertise between the public and private sectors.

These recommendations highlight that the success of transforming the financial ecosystem through digitalization does not depend solely on technology, but also on *the interaction between regulation, infrastructure and human capital.* A balanced framework, based on responsible innovation, can contribute to both *economic resilience* and *sustainable financial inclusion.*

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THE ROLE OF THE NATIONAL BANK OF ROMANIA IN REGULATING THE BANKING DIVIDEND POLICY – AN ESSENTIAL COMPONENT OF BANKING SUPERVISION

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Abstract:

In the Romanian banking system, National Bank of Romania (Banca Națională a României) in the institution which, according to Romanian law, is assigned, on one hand, with the "exclusive jurisdiction to authorize credit institutions" and, on the other hand, with the responsibility for "prudential supervision of credit institutions that authorized them to operate in Romania". One of the most important 'tools' at the command of National Bank of Romania in its 'arsenal' it uses to exert its prudential supervision of credit institutions is the dividend policy, as a means to 'streamline' shareholder returns so as to make sure capital will be available for the need of absorbing (potential) losses and also to make lending still possible, especially so during an economic crisis. For this – in principle –, prudential supervision can be exerted through restricting dividend payments to stakeholders in order to increase banks' capital buffers and their lending capacity.

Keywords: *prudential supervision, dividend, returns*

JEL classification: *E50, E58*

Introduction

The management of commercial banks must, from the point of view of the operating mechanism of a commercial bank, take care first of all to have a sufficient level of bank capital, for the normal conduct of banking activity.

Under "normal" conditions, management must take the necessary measures to increase the amplitude of credit offered to individuals and legal entities, for which a sufficient amount of bank capital is needed so that the bank does not resort to exceptional measures, namely - usually - to the reduction of bank assets, the effect of which is contraction in lending (Mishkin, 2022, p.250).

All the more so in an economic and financial crisis, when banks were having a hard(er) time due to both the fall of housing market, on one hand, and had to contend with the *increasing* number of debtors unable to make payments for their loans, on the otherhand,they are faced with capital reduction, which must be stopped quickly and decisively: as in 2008 and 2009,

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the method usually used for this was credit reduction, which *further* weakened the (global) economy (Mishkin, 2022, p.251).

Literature review

The National Bank of Romania (NBR) is, according to Romanian law, the **central** bank of Romania, the independent state institution and the *only* Romanian institution that is entrusted with achieving a fundamental goalfor a market economy, respectively with a fundamental attribution needed by it to achieve this goal:

I.The NBR's fundamental goal is ensuring and maintaining price stability (NBR, 2021, p.4);
II.Among its fundamental attributes, one of the most important is the authorization, regulation and *prudential supervision* of credit institutions, respectively the promotion and monitoring of proper functioning of payment systems to ensure financial stability (NBR, 2021, p.4).

According to Romanian law, **prudential supervision** is achieved through:

1.establishing benchmarks and indexes of prudential regulation
2.monitoring compliance with these and other requirements provided by law and applicable regulations
3.imposing any necessary measures, inclusively applying sanctions when appropriate, in order to prevent and limit banking **risks** (OUG, no. 99, 6 dec.2006, Titlul III, Capitolul I, Art. 164).

Romanian bank law makes NBR the only institution in Romania allowed tomonitor compliance with prudential requirements and other requirements provided – monitoring based onspecific reports and through inspections carried out at:

a) Headquarters of banks, Romanian legal entities, their branches and other secondary headquarters in the country and abroad (OUG, no. 99, 6 dec.2006, Art. 169);

b) The headquarters of branches of foreign credit institutions operating in Romania (OUG, no. 99, 6 dec.2006, Art. 169).

After Romania joined up European Union, BNR,as the institution responsible with authorization, regulation and prudential supervision of all Romanian credit institutions, the NBR recalibrated Romanian bank law– as part of the community *acquis*, respectively the specific policies in this regard, the emphasis falling on (Apetri, 2015, p.79):

1.Central bank independence;
2.Adjusting central bank regulations regarding payment system modernization;
3.Prudential requirements of commercial banks' lending;
4.Standardization of bank account coding (i.e., IBAN codes);
5.Gradual liberalization of foreign exchange transfer operations;
6.Adjusting regulatory requirements to combat money laundering.

In the specific field of banking system prudential *supervision*, the specific NBR*policies* in this field are, mainly, the following ones (with the observation NBR in *not* the only 'source' of(secondary) legislation on prudential supervision in Romania – NBR cooperates on this with Romania's National Securities and Exchange Commission and Romania's Insurance Supervisory Commission)(Apetri, 2015, p. 79):

1.Supervision of banking activity on an individual basis
2.Supervision of consolidated personal funds
3.Supervision of the solvency and large exposures of credit institutions
4.Extending accounting regulations to *all* credit institutions.

Methodology and Data

After economic crisis of 2007-2009, National Bank of Romania adopted measures needed for strengthening the legal framework of prudential regulation, aiming in particular to avoid the *accumulation* of risks in the banking system, by (Apetri, 2015, p. 79.):

i. Modification of computing method for personal funds of credit institutions
ii. Introducing additional requirements for preparation of alternative liquidity risk management plans in crisis
iii. Development of legal regulations to improve risk management of consumer credit.

As far as European Union is concerned, European Central Bank (ECB) absorbed the "lessons" of the recent financial crisisand, as a result, issued a series of recommendations for the effective conduct of prudential supervision of banking sector in all European Union member states, starting from the practical observation that the *essential* thing, in terms of functioning of commercial banks, is their ***lending*** activity, which can only be achieved if they protect their ***capital bases*** - the minimum target being compliance with *minimum capital requirements*.

Thus, in 2015, the ECB issued a RECOMMENDATION on ***dividend distribution policies***, indicating the following minimum requirements (ECB/2015/49):

Credit institutions should implement dividend policies prudently and in a conservative manner, so that, after distribution, they **meet** the applicable capital **requirements**, namely:

-To comply at all times with the applicable minimum capital requirements ('Pillar 1 requirements'). These include a Common Equity Tier 1 (CET1) ratio of 4.5%, a Tier 1 ratio of 6% and a total capital ratio of 8% as set out in Article 92 of Regulation (EU) No 575/2013 (ECB/2015/49, p.2).
- To meet at all times the capital requirements imposed as a result of the applicable decision on the supervisory and evaluation process for the application of Article 16(2)(a) of Regulation (EU) No 1024/2013 and which exceed the Pillar 1 requirements ('Pillar 2 requirements') (ECB/2015/49).
- To comply with the systemic and countercyclical capital buffers set out in Article 128(2), (3), (4) and (5) of Directive 2013/36/EU and all other buffers set by national competent authorities and national designated authorities (ECB/2015/49).
- To comply with the requirements applicable to them regarding the Common Equity Tier 1 ratio, the Tier 1 ratio and the “fully loaded” total capital ratio (1) – until the end of the applicable transitional period (ECB/2015/49).

These recommendations on dividend distribution policies are designed to ensure that commercial banks have *adequate* capital in any situation, or, in other words, of an adequate ***amount*** in order to *prevent* the situation in which banks have insufficient capital to cover exposure to credit, market and operational risk (Mishkin, 2022,336).

In order to make sure this is *done*, ECB has designed its recommendations around the “core” of the “Pillar 1” requirements on the applicable minimum capital requirements, namely the Common Equity Tier 1 (CET1) *ratio*, an indicator whose main characteristics are:

1) Capital adequacy ratio is an index which measures value of bank's capital divided by bank’s assets – these assets, being classifiable, from a prudential angle, according to credit and market risks, are included in the calculation of the capital adequacy ratio as ‘weighted values’, according to the risks they are subjected to (BIS, Definition of capital in Basel III);

2) Thus, *Tier 1* capital ratio is used toassess if a *sufficient* amount of capital is at the disposal of a bank, because this ratio reflects the highest level of capital quality defined by

banking legislation – these own funds usually include shares, retained earnings and other reserves.

The need to observe the relationship between banks' dividend distribution policies to their shareholders and the equity's*quality*, on the one hand, and to actively support the *increase* in the quality of equity, on the other hand, proved indispensable not only during and after the 2007-2009 crisis, but also later – namely, as an indispensable measure to protect banking systems from the effects of COVID pandemic (2020-2021), in which the imposed lockdown (including in Romania) produced a series of negative, cascading effects:

- Sudden economic contraction;
- Significant increase in credit risk;
- Increasing pressure on liquidity.

Technically speaking, it can be admitted these recommendations have the intended effect, insofar as ECB recommendations *inclusively* must be enforced by *each* bank's management. But, still, more is needed, as capital structure of each bank is different, each bank applies rules and recommendations in its own*particular* way, management of dividend distribution policies inclusively, and, above all, asbanks exist in a (banking) *system*, and so also function as its *components*.

Results

When experiencing a financial crisis, or even a financial-*monetary* crisis (i.e. the Greek crisis, *triggered* by the economic crisis of 2007-2009), the banking *system* is unbalanced, including from the imprudent distribution of dividends, in two main ways (Mishkin, 2022, p.337):

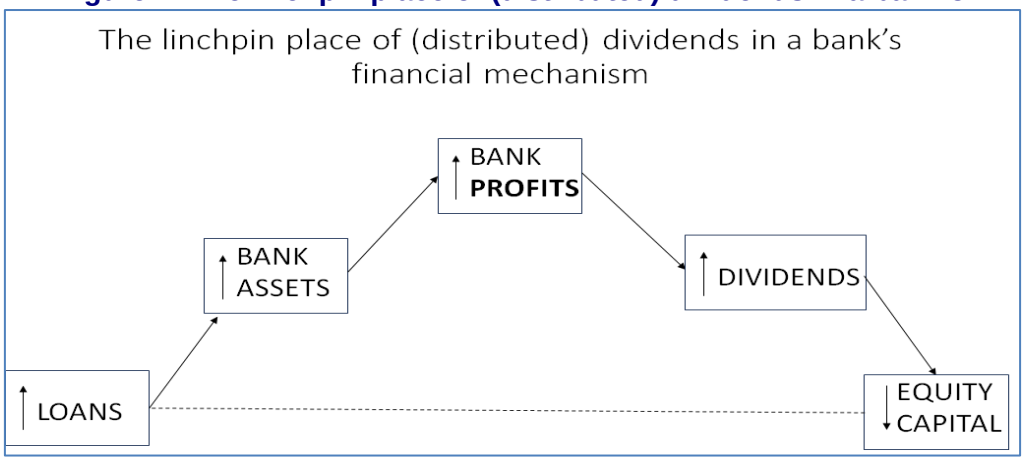
1.On one hand, the impact on the lending capacity of some banks had the effect of risks (credit, market and operational) and losses being "exported" from "ill" banks to (still) "healthy" banks - causing the latter to be negatively affected in turn;

2. On the other hand, when banks affected by the crisis, including through the distribution of dividends, tried to maintain their position by (forced) selling part of their assets, the resulting effect – e.g. the obtained effect, not the *desired* one – was a significant decrease in the value of those assets.

This bank interdependence also produced the (apparently) paradoxical effect of the technical existence of high capital ratios – i.e. 'benchmarks' box-ticking' –, in other words of standards satisfied that could not protect banks from losses. To which it is added the real, if at best marginal, inability of prudential supervision to detect (all) imprudent/risky and/or illegal banking operations.

A second interdependence is that between the effects of dividend distribution policy on bank's financial-accounting "health" and banking mechanisms from which the very distributed dividends are *issued*– namely the bank's **profit**: the increase in banking **assets** (i.e., the volume of performing loans granted by the bank) determines the increase in the bank's profit, a part of which is – or can be – allocated for distribution of dividends. Graphically, this economic mechanism is shown in the graph below:

Figure 1: The linchpin place of (distributed) dividends in a bank's



Source: authors' conception

Conclusions

The graph above is very apt to convey several conclusions, *inclusively* on the role of National Bank of Romania in regulating the banking dividend policy, with the *administrative* insights on the working and mechanisms of national banking *systems* – in our case, in European Union, in general, and in Romania, especially –, but, in the first place, on the ***economic mechanism*** with yield the very money any bank *can* use for distributing dividends to bank's stakeholders.

On one hand, there is a *link* between the size of a bank's equity capital and its loans volume – whence its asset size; and, it is a fact this link is gauged, in a sense, by the volume of distributed dividends: if this is rising, equity capital tends to fall and so the bank's power to grant loans.

On the other hand, *the circuit* described in Graph 1 *is not closed: not quite so, and definitely* ***not*** *by the (volume of) distributed dividends*, in a given quantitative frame, of course; that is, bar the possibility – or the need to counter to the best of one's ability – of an economic and/or financial crisis, distributing a 'reasonable' volume of dividends will not impair a bank's power to grant (more) 'healthy' loans, and therefore to grow its profits. But whatever dividends *are* distributed will inevitably diminish its equity capital, and so its gross *capacity* to grow its assets.

This is why a prudent bank dividend distribution policy must take into account, now and in the future, volume of said dividends notwithstanding, both the structure of its loans portfolioand the structure of its equity capital.

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STRATEGIES FOR RISK DIVERSIFICATION IN MICROFINANCE INSTITUTIONS AND THEIR IMPACT ON THE RESILIENCE OF THE SECTOR IN THE REPUBLIC OF MOLDOVA

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Abstract

Microfinance institutions (MFIs) play a crucial role in promoting financial inclusion and supporting vulnerable groups in the Republic of Moldova. However, the sector faces multiple challenges related to credit risk concentration, liquidity fluctuations, regulatory pressures, and macroeconomic instability. This paper analyzes the strategies of risk diversification applied by MFIs and assesses their contribution to strengthening sectoral resilience. Particular attention is given to the impact of innovative financing mechanisms, such as blended finance and guarantee schemes, in reducing vulnerability to external shocks. Empirical evidence from the Moldovan microfinance market indicates that institutions with a diversified risk management framework demonstrate higher financial stability, lower default rates, and greater adaptability to crises. The findings suggest that fostering risk diversification strategies not only enhances the sustainability of microfinance institutions but also contributes to the resilience of the national financial system as a whole. The article was developed within the framework of Subprogram 030101 „Strengthening the resilience, competitiveness, and sustainability of the economy of the Republic of Moldova in the context of the accession process to the European Union", institutional funding.

***Keywords**: Risk management, microfinance institutions, research, sustainable, resilience*

***Jel classification**: G21, G32, O16, E44, Q01*

Introduction

Microfinance institutions (MFIs) play a critical role in increasing financial inclusion, especially in emerging economies such as the Republic of Moldova, where access to traditional banking services remains limited for certain segments of the population, including low-income households, rural communities, and small entrepreneurs. By providing microcredit, savings products, and other financial services, MFIs contribute to poverty reduction, income generation, and local business development. However, the sustainability of these institutions largely depends on their ability to effectively manage risks, given that they operate in an

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environment characterized by economic volatility, regulatory changes, and high exposure to social vulnerabilities.

Risk diversification strategies are fundamental to strengthening the resilience of MFIs, ensuring their ability to withstand shocks and maintain their long-term operational stability. Such strategies typically include diversifying the loan portfolio across sectors, regions and client categories, adopting innovative financial products, developing partnerships with commercial banks and development organizations, and integrating technological solutions that enhance efficiency and reduce operational risks. At the same time, effective risk diversification contributes to reducing credit concentration, mitigating systemic vulnerabilities and supporting the financial stability of the sector.

In the context of the Republic of Moldova, the importance of risk diversification within MFIs has become increasingly evident in recent years, given the dual challenge of macroeconomic instability and external shocks, such as remittance fluctuations, inflationary pressures and spillovers from regional crises. Moreover, the supervisory framework established by the National Commission for the Financial Market (NCFM) and the gradual process of harmonization with European Union regulatory standards emphasize the need for a more robust approach to risk management in the microfinance sector.

This paper analyzes the strategies used by MFIs in the Republic of Moldova to diversify risks and assesses their impact on the resilience of the sector. By combining theoretical perspectives with empirical analysis, the study aims to contribute to the academic debate on sustainable microfinance and provide practical recommendations for strengthening the capacity of MFIs to support inclusive and resilient economic development.

Literature review

Credit risk has been linked to recent criticism of the microfinance industry over excessive interest rates and coercive collection practices (Bateman, 2010). A dramatic example is the suicide crisis in India (2010), attributed to the abusive recovery of outstanding microloans (Bandyopadhyay & Shankar, 2014), which highlighted the need for robust credit risk management strategies within microfinance institutions. The present study is therefore relevant to practitioners and stakeholders in the field – managers, donors, investors and regulators.

Although the empirical literature examines the effects of diversification on banking risk, there is still no consensus (Bandelj, 2016). According to modern portfolio theory, regional diversification allows for the elimination of specific risks and the reduction of total exposure. Thus, Fang and Lelyveld (2014) demonstrate the benefits of international diversification by reducing credit risk. Similarly, after the adoption of the Riegel–Neal Act (1994) in the USA, interstate bank expansion led to a decrease in credit risk (Akhigbea & Whyte, 2003) and deposit risk (Aguirregabiria, Clark & Wang, 2016). Deng and Elyasiani (2008) confirm, in turn, that diversification reduces bank risk and suggest that expanding customer portfolios contributes to decreasing the probability of bank failure. In contrast, studies based on agency theory suggest that banks should avoid diversification, as monitoring remote operations is difficult. As a result of insufficient supervision, branch managers may pursue personal goals at the expense of institutional ones (Goetz, Laeven & Levine, 2012; Bandelj, 2016). Diversification also increases the complexity of banking operations, making it more difficult for headquarters to monitor loans and control risk (Acharya, Hasan & Saunders, 2006; Winton, 1999). Gulamhussen, Pinheiro, and Pozzolo (2014) find that, contrary to the findings of Fang and Lelyveld (2014), international diversification increases bank risk. To date, the

literature has paid limited attention to the diversification versus concentration (i.e., non-diversification) dilemma in the rapidly expanding microfinance industry. This research gap is surprising given the scale of the phenomenon: in 2016 alone, microfinance institutions provided total loans of $102 billion to 132 million low-income beneficiaries globally (Convergences, 2017). Our study uses a sample of 657 microfinance institutions from 88 countries, covering the period 1998–2015, providing the first international evidence on the issue of diversification in microfinance.

The results indicate a positive relationship between diversification and credit risk: geographical diversification is associated with higher risks. This increase in risk is explained by the difficulty of monitoring operations remotely, but also by the tendency of institutions to expand into similar economic areas (e.g., rural areas), characterized by common systemic factors, which limits the benefits of diversification. For these reasons, the net effect of geographical diversification in microfinance is increased exposure to credit risk.

The results of research and discussions

The research highlights several relevant findings regarding the role of risk diversification strategies in strengthening the resilience of microfinance institutions (MFIs) in the Republic of Moldova. First, empirical data confirms that diversifying the loan portfolio across sectors and regions significantly reduces the vulnerability of MFIs to systemic shocks. Institutions that have registered a higher degree of diversification have demonstrated stronger financial indicators, lower levels of non-performing loans, and a greater capacity to adapt to fluctuations in the macroeconomic environment.

Second, the adoption of technological innovations – such as digital lending platforms, mobile payments, and automated credit scoring systems – has contributed to increasing operational efficiency and reducing the risks associated with information asymmetry. These practices are gradually being implemented in the Republic of Moldova, with the support of partnerships with commercial banks and international donors, although the degree of penetration remains uneven across institutions.

Third, discussions with experts and practitioners in the field highlight that effective diversification is not limited to financial products and client categories, but also includes governance structures, funding sources, and institutional partnerships. MFIs that actively collaborate with development organizations and external investors have been able to access more stable sources of funding, which has increased their resilience in times of economic uncertainty.

Finally, the regulatory and supervisory framework in the Republic of Moldova, although gradually aligning with European Union standards, still faces challenges related to ensuring a level playing field, improving risk reporting systems, and strengthening consumer protection. These aspects are essential to allow MFIs to expand their risk diversification strategies and strengthen their contribution to inclusive and sustainable economic development.

The author then elucidates his own vision of the strategic management model of non-bank lending organizations (NBLOs) in the Republic of Moldova.

Thus, the strategic management of non-bank lending organizations (NBLOs) in the Republic of Moldova is a complex and dynamic process, aimed at ensuring sustainability, competitiveness and institutional resilience. In our view, the appropriate strategic management model for this type of organization must be based on four main pillars: strategic thinking, strategic analysis, strategic approach and strategy implementation.

1. Strategic thinking (strategic initiation) - This stage represents the starting point of the strategic management process and consists of defining the general direction of development of the organization. For MF/NBLOs, strategic thinking is based on the nature of the activities carried out - granting loans to the population and microenterprises - and aims to formulate the mission, vision and values of the organization. A central element is decision-making regarding the allocation of resources, a process that determines development priorities and sets guidelines for the future.

2. Strategic analysis - Strategic analysis involves evaluating the internal and external environment of the organization, in order to determine its position in the market. Internal analysis takes into account variables such as: the purpose and task of the organization, the structure, the technology used, human resources and organizational culture. External analysis focuses on factors of direct influence (customers, competitors, suppliers) and indirect (macroeconomic conditions, legislative framework, social and technological trends). By combining these dimensions, MFIs /OCN can identify their competitive advantages, vulnerabilities and development opportunities.

3. Strategic approach - This stage involves the use of modern tools for strategic analysis and planning, designed to support the decision-making process. Among the most relevant tools are:

- SWOT analysis and PESTLE analysis, for the assessment of internal and external factors;
- Balanced Scorecard, for the establishment and monitoring of strategic objectives;
- Analysis of the financial situation and quality of the loan portfolio;
- Assessment of human resources and their potential;
- Analysis of the current and prospective competitive position;
- Application of innovative methodologies, such as the “Blue Ocean” Strategy or the Scoreboard.

In our opinion, the process of developing a strategy at the MFIs /OCN level should be carried out in five successive stages:

- Assessment of the current situation (“What do we have at the moment?”).
- Definition of strategic and operational objectives (“What do we want to achieve?”).
- Establishment of development directions (“How can we achieve the proposed objectives?”).
- Choosing the type of planning (short, medium or long term).
- Developing and documenting the strategic plan, as a tool for coordinating the organization's activities.

4. Strategy implementation - Implementation is the final and most important stage, as it reflects the organization's ability to transform the formulated objectives into concrete results. This includes the accumulation and efficient use of resources, establishing operational plans, correlating strategic plans with annual budgets and marketing plans, as well as establishing mechanisms for periodic control and performance evaluation. Permanent monitoring of

progress and adjusting strategies according to changes in the external environment are essential conditions for the success of the strategic process.

In this context, for MFIs, strategic planning represents identifying the organization's vision and preparing for the future through efficient and effective strategic management, in the next year or between 3 and 5 years, although some extend their vision to 20 years. In order to achieve a coherent strategic plan that is based on planning, it is necessary to analyze the current situation, strategic and operational objectives of microfinance organizations.

Table 1: Strategic planning within the MFIs

OMF Management Levels	Short-term planning (1 year)	Medium-term planning (2-3 years)	Long-term planning (3-5 years)
OMF Management	Approval of strategic plans and formation of development funds	Strategic tasks and objectives	Direction of activity and mission of the OMF
OMF Departments	Development of action plan	Departmental activity programs	Instructions containing directions and spheres of activity
Functional-Operational Level	Plans and budget	Regulations and programs	Directions of operational activity
	Strategic documents		
	Organizational Strategy	Annual Budget and Marketing Plan	

Source: elaborated by the author.

Table 2: Strategic plan within the MFIs

Current Situation Analysis (present)	Strategic Plan – Medium Term (3/5 Years)
✓*Analysis of trends in the sector in which the organization operates;* ✓*Market analysis;* ✓*Competitive analysis;* ✓*Market segmentation;* ✓*SWOT analysis, PESTLE, Dashboard, Blue Ocean Strategy;* ✓*Positioning – perception analysis;* ✓*Information sources.*	✓*Analysis of strategic and programmatic documents;* ✓*Trends and market segmentation by sector in which the organization operates;* ✓*Proposals for strategic and operational objectives, following the SWOT analysis;* ✓*Positioning with respect to other market players, as well as perceived gaps;* ✓*Positioning with respect to the services offered.*

Source: elaborated by the author.

Another necessary and important tool for microfinance organizations is the application of the Conceptual Balanced Scorecard (BSC) which translates the mission and strategy of an organization into a set of performance indicators that provide a model for a strategic and managerial measurement system. According to Chow et al. (2007), the process of designing and implementing a performance management system based on the BSC can take two or more years. Thus, in the implementation case described by Dr. Kaplan and Dr. Norton, it is

necessary to take into account the fact that the introduction of the BSC was designed for a complex organization with multiple management structures. This tool was created in 1992 by Kaplan & Norton at Harvard Business School and has undergone a revolutionary process of improvement, from a performance measurement framework (1990-1996) to a performance management tool (1996-2000), to become the best practice in strategic management recognized worldwide.

The essential components of the Balanced Scorecard (BSC) are structured in 4 perspectives, linked by cause-effect relationships: financial; customers; internal processes; personnel and innovation.

The Balanced Scorecard (BSC) is a management system that translates strategy into action. The effects of its implementation are obvious for the organization:

- ✓ Helps clarify the strategic plan;
- ✓ Translates the strategy into concrete actions that can be executed;
- ✓ Analyzes the compartments of the institution's strategy;
- ✓ Communicates the strategy at all levels of the institution;
- ✓ Helps monitor the execution of the strategy.

The Balanced Scorecard (BSC) together with the graphic illustration through strategic maps provides a logical and comprehensive way of describing the strategy. Thus, with a BSC, which reflects the strategy, we have a secure foundation for designing a management system for creating an organization focused on strategy.

Strategic management within microfinance organizations in the Republic of Moldova is a complex and dynamic process, which aims to foresee and implement, through strategic decisions, future changes in the activity of organizations in the sector. When developing the development strategy of a microfinance organization, the analysis of the microfinance sector in the Republic of Moldova was taken into account, including the analysis of services, the clear and consistent situation of the institutional and regulatory framework, as well as the problems that can be solved with the joint efforts of the state and a wide circle of organizations involved in microfinance.

The specialized literature contains the necessary characteristics that a strategic management model must meet:

1. Coherence given by the quality of representation to capture compatible connections between the various components and stages of the represented process;

2. Correctness reflected in the model's ability not to distort the real nature of the presented relationships;

3. Consistency and completeness appreciated by the extent to which the component elements of the modeled process and the relationships between them are represented;

4. Efficiency and reliability given by the quality of the model to solve problems at an acceptable cost with an effort of training and use in relation to the effects obtained [81].

Next, we propose the development of a strategic management model for MFOs in the Republic of Moldova according to the methodological aspects, elucidated in Table 3.

The strategic management process of the microfinance organization can be represented

synoptically in the form of a model. Therefore, the model starts from the four fundamental dimensions of strategic management (thinking, analysis, approach, implementation), but adapts them to the specifics of the MFO.

Table 3: Strategic management model and forecast for MFIs

Strategic Model Stages	Indicatory
Assessment of the Current Situation	✓ Analysis of financial indicators (repayment rate, portfolio at risk – PAR30, profitability). ✓ Analysis of the external environment: competition, macroeconomic conditions, regulations (CNPF). ✓ Internal questionnaires and customer surveys to identify vulnerabilities
Establishment of Strategic Directions	1. Product diversification: loans, micro-savings, insurance, micro-leasing. 2. Geographic expansion (rural areas). 3. Digitalization (mobile applications, automated scoring).
Development of the Strategic Plan	➢ Short term (1 year): budget, marketing plan, risk plan. ➢ Medium term (2–3 years): portfolio development, capital consolidation, partnerships. ➢ Long term (5 years): sustainability, innovations, adaptation to EU standards.
Implementation and Monitoring	1. Performance Indicators (KPI): ✓ Portfolio at Risk (PAR30) < 5% ✓ Repayment Rate > 95% ✓ Portfolio Growth > 10% Annually ✓ Financial Self-Sufficiency Rate (FSS) > 120% 1. Internal Audits and Quarterly Reports.

Source: elaborated by the author.

For a macroeconomic model to analyze the resilience of microfinance institutions (MFIs), it starts from the hypothesis that their performance and stability are directly influenced by developments in the national and international economic environment. In the conditions of the Republic of Moldova, where the non-banking financial sector is highly exposed to macroeconomic fluctuations and external risks, an integrated approach is needed that connects MFI-specific indicators with macroeconomic variables. A set of equations is used to link MFI performance to the macroeconomic context:

1.Loan portfolio dynamics:

$$VPC_{t+1} = VPC_t \, x \, (1+g - \theta * \pi_t - \lambda * i_t) - PAR30_t$$

Where: g = expected growth rate,

π_t = inflation,

i_t = interest rate,

θ and λ = sensitivity coefficients.

2. Evolution of the portfolio at risk (PAR30):

$$PAR30_{t+1} = PAR\ 30_t \, x \, (1 + \alpha * U_t - \beta * Y_t)$$

Where: U_t = unemployment rate,

Y_t = GDP growth,

α and β = impact coefficients.

3. Financial Resilience Index (IRF):

$IRF = (ROA + ROE + RR) / (1 + PAR30 + \sigma_{macro})$

Where: σ_{macro} = macroeconomic volatility (standard deviation of GDP and inflation).

A high level of IRF (>1) indicates increased resilience, while values <1 suggest vulnerability.

Table 4: Example forecast (moderate scenario, Moldova 2025–2030)

Year	Real GDP (%)	Inflation (%)	VPC (mil. MDL)	PAR30 (%)	RR (%)	ROE (%)	IRF
2025	3.5	6.0	500	4.5	95.0	8.0	1.10
2026	3.8	5.5	550	4.8	95.2	8.5	1.12
2027	4.0	5.2	605	5.0	95.5	9.0	1.14
2028	4.2	5.0	670	5.2	95.7	9.2	1.15
2029	4.3	4.8	740	5.5	96.0	9.5	1.17
2030	4.5	4.5	815	5.8	96.2	10.0	1.20

Source: elaborated by the author.

The macroeconomic model allows assessing the resilience of microfinance institutions in the Republic of Moldova according to macroeconomic and sectoral variables. The results show that, in a moderate scenario, the loan portfolio can grow by 10% annually, while the financial resilience index (FRI) gradually strengthens, suggesting increased sustainability of the sector.

Conclusions

The resilience of microfinance institutions refers to their ability to adapt to and cope with economic and social changes, financial or political crises, and other external events that may affect the sector's activity and sustainability. In a context characterized by macroeconomic instability and volatility of the external environment, strengthening MFI resilience becomes a fundamental condition for ensuring operational continuity and maintaining their role in supporting financial inclusion.

A central element of MFI resilience is risk and crisis management. Institutions must develop clear and proactive strategies to deal with economic recessions, global crises, or market instability. These measures include establishing reserve funds, restructuring loans, and making repayment terms more flexible for vulnerable clients.

At the same time, flexibility and speed of response are essential factors. Resilient microfinance institutions are able to promptly adjust their products and lending conditions, depending on the new economic realities. Digitalization of processes, the use of online

platforms and modern credit scoring tools increase the ability to react quickly and support adaptation to shocks.

MFI resilience is closely correlated with the diversification of financial products and services. A sustainability-oriented institution is not limited to providing loans, but also develops savings services, insurance and financial protection instruments, thus reducing dependence on a single line of business.

Innovation in financial services also plays a major role. Digital microfinance products, such as mobile applications or electronic payments, allow for the expansion of access to finance, including to rural areas or isolated communities. This type of innovation contributes not only to resilience, but also to increasing financial inclusion in the Republic of Moldova.

Resilient institutions are those that have effective mechanisms for managing political and economic risks. In an economy marked by instability and frequent legislative changes, it is necessary to develop strategies for adapting to regulatory changes, including through constructive dialogue with supervisory authorities and by strengthening transparency.

In addition, responding to climate and environmental risks is becoming increasingly important. Events such as drought or floods directly affect small farmers – a major segment of MFI clients – and, implicitly, the portfolio of microfinance organizations. A resilient strategy involves developing financial products designed to manage climate risks, including green loans and microinsurance products adapted to local specificities.

- Challenges to resilience and sustainability of the microfinance sector in the Republic of Moldova

- The development of MFI resilience in the Republic of Moldova is limited by a number of structural factors:

- Restricted access to external capital – difficulties in attracting international financing reduce the ability of MFIs to expand their client portfolio and respond to the demands of a constantly changing market.

- Economic and political instability – regional crises, economic volatility and political uncertainty affect both the level of confidence of external investors and the efficient functioning of microfinance organizations.

- Low level of financial education – lack of financial knowledge among clients limits the impact of microfinance, increasing the risk of over-indebtedness and reducing the sustainability of lending relationships.

Overall, the resilience of microfinance institutions in the Republic of Moldova depends on their ability to adapt to crises, diversify products and services, as well as effectively manage external risks. Strengthening this process requires not only internal management tools, but also external support in the form of access to capital, institutional stability and investments in the financial education of the population. In this way, microfinance can become a pillar of inclusive and sustainable economic development, contributing to increasing social and economic resilience at the national level.

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DEGLOBALIZATION AND ITS FINANCIAL IMPLICATIONS: A THEORETICAL PERSPECTIVE

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Abstract

The slowdown in globalization after the Global Financial Crisis in 2008 and the sovereign debt crisis in the Eurozone, especially after 2015, is due to deep structural transformations in the international economy and finance, increasing trade protectionism, growing regulatory burdens, and geopolitical instability. The report systematizes, from a theoretical point of view, the main driving forces behind the slowdown in globalization, the waves of globalization and deglobalization in the world economy, and the possible financial consequences of deglobalization. The analyzed theoretical aspects of deglobalization point to an intensification of the role of state intervention with negative consequences for the process of financial integration, with a refocusing of financial operations on local capital markets.

Keywords*: financial deglobalization, trade protectionism, capital markets*

Jel classification*: F40, F66, G19*

Introduction

In the context of growing global protectionism, it is necessary to assess theoretically the impact of Deglobalization 3.0 on stock markets (e.g., the KOF index, etc.) due to the redirection of trade flows to domestic markets and regions and the refocusing of investment flows to local securities, a heightened trend toward diversification in local assets due to capital constraints, and an increasing level of risk in the global environment. Among the negative aspects of deglobalization processes are increased structural vulnerabilities, especially in small countries with highly open economies, such as Bulgaria, due to limited access to external sources of financing (such as portfolio investments), limited FDI inflows, underdeveloped capital markets, and high dependence on global value chains.

After the 2008 financial crisis, there has been a slowdown in the pace of globalization due to structural transformations in the international economic system and the trend towards mass trade protectionism, a decline in FDI and a shift of investment towards structurally important sectors related to national security, and screening of incoming FDI. Changes are taking place

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in the economic model of international trade in the course of the economy's transition to digitalization, which implies localized models of production and trade.

In theoretical terms, the periodization of the process of globalization and deglobalization establishes that, on average, each wave of globalization and deglobalization lasts about 20 years, with low-income countries being the main losers from deglobalization processes in the international economy. For the current wave of Deglobalization 3.0, in addition to the 2008 global financial crisis and the ensuing recession and Eurozone debt crisis, exogenous factors include the global COVID-19 pandemic of 2020 and the military conflict in Ukraine of 2022, leading to a refocusing of economic activities (so-called "reshoring" and "friendshoring") on a regional basis, with a subsequent reorganization of global supply chains and new challenges to the process of diffusion of technological innovations and economic growth on a global scale.

In the context of the new technological and economic paradigm, dominated by artificial intelligence with the transition to digitalization of economies and intensifying deglobalization processes, a new model of innovative economic development is emerging, with a dominant role for the entrepreneurial state, due to the negative consequences of the neoliberal model of financialization of economies and the need to guarantee global public goods (such as environmental protection, national security, etc.) due to growing weaknesses in the institutional structure and a retreat from democratic values.

Deglobalization and its dimensions

The research paper introduces a clarification to highlight in theoretical frame the trends towards deglobalization or delayed globalization in the field of international finance, setting as a limitation not to analyze aspects in the field of international trade and international labor migration. For the first time, the concept of deglobalization or delayed globalization was used by Bakas et al. (2016) in connection with the reported slowdown in the pace of international trade in the period after the 2008 Global financial crisis (GFC). Bruelgel (2022) connects deglobalization with a decrease in connectivity between countries in trade in goods, services, capital flows, movement of people and technology transfer.

According to Kandil et al. (2020), among the main driving factors for slowing down the globalization process are: low labor costs; rapid response to changes; promotion of competition between suppliers; facilitation in the process of logistics operations; focus on core company competencies; facilitation of strategic market penetration, etc. Other constraints to globalization can be included here, such as: decline in product and process technological competencies, reduction in long-term levels of competition in R&D, accumulation of significant inventories, problems in logistics and in particular in communications and coordination; increasing transaction costs and boosted costs of fuel and transportation in international trade.

For Stanoevic et al. (2023), the reasons for the decline in international trade, FDI and in global value chains should be sought in structural transformations in the international economic system and this requires an analysis of such indicators as inward and outward FDIs, foreign trade (imports and exports), value added in global chains, an increase in the regulatory burden, especially after the GFC since 2008. According to Evenett (2019), the trend towards mass trade protectionism should also be taken into account as a symptom of slowing globalization of the international economic system.

Often cited reasons for the slowdown in international trade in goods, which went from 24% of world GDP (1960s) to around 60% by 2008, are a decline in economic activity and GDP

growth (IMF, 2015), cyclical factors such as falling prices, demand and imports (Boz et al. 2020), protectionist measures such as tariffs, non-tariff barriers, tightening of customs rules in the period 2008-2018, the need for radical reforms in the work of international organizations such as the IMF, the World Bank, the G20 and the WTO. In the course of technological innovation in the world, there is also a decrease in final value added, as an indicator of economic integration in global value chains, and an increase in the share of services in trade. For the period 2008-2018, there was a decline in the share of final value added in exports from 31% to 27% according to OECD, UNCTAD, World Input-Output Database. After 2021, a sharp increase in global imports was reported due to the Covid-19 pandemic according to World Bank research (2020), especially concerning trade in intermediate goods within global value chains, which account for over 50% of global trade (Brooking Papers, 2023).

In particular, FDI flows have reported a faster decline than international trade, and especially after 2011 with the onset of recession in developed countries in the world. Due to the GFC, the growth in FDI was about 8%, with a decline of about 23% in 2017, and another 13% in 2018. Inward FDIs in developed countries fell by around 27% in 2018, with some European countries specifically experiencing negative FDI levels due to the withdrawal of investment funds from the US (so-called “reshoring”). According to UNCTAD (2019), the share of restrictive measures on FDI increased from 10% to 34% in the period 2003-2018 for national security reasons, covering sectors such as energy, telecommunications, electrical components, robotics, artificial intelligence, etc. Among these restrictive measures stands out the screening mechanism for inward FDI, introduced in over 20 countries, whose FDI flows account for over 50% of the total level of FDIs in the world.

Stanoevic et al. (2023) study the impact of the globalization slowdown on China's economy, using an autoregressive distributed lag (ARDL) model for short-term effects and a cointegration test to establish long-term interdependencies for the period 1991-2021 with the dependent variable China's GDP and independent variables: inward FDI/GDP, outward FDI/GDP, imports and exports to GDP, and final value added/exports. The results of the empirical analysis show a high dependence of GDP growth on changes in international trade, investment, and production. Inward FDI has the strongest impact on China's GDP. An increase in this indicator by 1 percentage point in a given year contributes to a growth in China's GDP by 1.03 percentage points in the following year. On the other hand, an increase in outward FDI by 1 percentage point is associated with an increase in GDP by 1.87 percentage points in the following year, and the growth of imports by 1 pp. correlates with an increase in China's GDP by 1.01 pp. In the long term, the empirical results report a strong influence of the variables, but weak statistical significance since the included indicators depend on external environmental conditions. The results point to a new paradigm with a growing role of China as a global investor with the potential for deglobalizing effects on the world economy.

Factors contributing to slowdown in globalization

Among the factors contributing to the slowdown of the globalization process (Bergeijk, 2020) stand out: 1) changes in the economic model in the course of the digitalization process and the introduction of new technologies and robotics, 3D printing, etc., providing cost-effective means for localized production, close to end users; 2) growing concerns about protectionism and anti-globalization sentiment with a potential shift towards state isolationism (growing concerns about job losses, falling real wages, deindustrialization, social inequalities, job displacement, etc. increasingly intense conflicts over trade and financial regulation and

increasing hostility towards migration); 3) escalating trade tensions (e.g. between the US and China, which have been in a state of trade war for several years). Trade policy tensions are not limited to the US-China dispute. The US is also threatening high tariffs on EU goods and has ongoing disputes with India and Vietnam; 4) post Covid-19 situation is contributing to nationalist policies and is likely to have long-term negative consequences for globalization with a rethinking of supply chain strategies (shortening or diversifying supply chains to improve reliability of supply) and concerns about food security in some countries; 5) tariffs can be raised to support climate change policies, introducing new regulations to reduce carbon emissions, making geographically dispersed chains even more expensive; 6) reducing greenhouse gas emissions by imposing tariffs and adopting carbon border taxes against countries that withdraw from the Paris Climate Agreement.

As can be seen from the periodization in Table 1 below, the second wave of globalization (the so-called “Globalization 2.0”) from the second half of the 19th century to the World War I, is associated with the advancement of transport technologies and the reduction of tariffs and other restrictions on international trade and the hegemonic status of Britain in international relations. The third wave of globalization (the so-called “Globalization 3.0”) is associated with the period of recovery after World War II with the Marshall Plan, the Bretton Woods Conference and the establishment of the IMF, GATT and later the WTO, and continued until 1980 with the leading country - the hegemonic status of USA. This was followed by the establishment of a plateau in the globalization process after 1981 to 1993, and this period is associated with the consequences of the two oil crises of 1973-1974 and the debt crises in Latin America. Globalization 4.0 continued after 1994 until the beginning of the GFC of 2007-2008 and is associated with increasing trade and financial liberalization after the collapse of the Soviet Union, and the period of economic expansion in the Asian region. For Mokyr (2017), there is a positive correlation between the increase in trade and financial liberalization during this period and the rapid technological progress on global scale. As a sub-period of globalization, hyper-globalization of the 1990s reported a rapid increase in world trade due to a decrease in transaction costs with the introduction of new technologies, China's integration into the WTO, an increase in FDI flows, as well as industrial production.

Table 1: Periodization in globalization and deglobalization

Period	Start	End	Duration (years)
First Wave of Globalization (1.0)	1849	1878	29
Deglobalization 1	1879	1901	22
Second Wave of Globalization (2.0)	1902	1920	18
Deglobalization 2.0	1921	1944	23
Third Wave of Globalization (3.0)	1946	1980	35
Plateau	1981	1993	12
Fourth Wave of Globalization (4.0)	1994	2008	14
Deglobalization 3.0	2009	?	?

Source: adapted from Chase-Dunn, Christopher, Alexis Álvarez, and Yuhao Liao (2023)

According to Bergeijk (2020), the mechanism of slowing down globalization is associated with: 1) Redistributive processes from globalization at the national level, where a layer of the labor force stands out that is in a position of losing from increased globalization, and this

necessitates the adoption of protectionist measures, especially in leading economic countries, which signals an initial stage of political deglobalization. According to Stiglitz (2005), the losers from the globalization process are mainly countries with low income per capita, in which trade liberalization leads to a decrease in productivity and an increase in the unemployment rate. A correlation is established between globalization and the growth of income inequality in a global aspect. 2) An external shock in the form of a financial crisis and/or the onset of a global (military) conflict. “Deglobalization 2.0” is associated precisely with the occurrence of the stock market crash in the USA in 1929, the subsequent Great Depression in the 1930s in the course of increasing trade protectionism in the USA, and the customs restrictions and quotas imposed by the Smooth-Hawley Act, as well as the concomitant outbreak of the World War II.

In the study by Bergeijk (2020) in the current phase of “Deglobalization 3.0” the cyclical process of slowing down globalization is associated with the recession caused after the 2008 GFC and with the subsequent collapse in the indicators of world trade and investment. According to a study by Goldman Sachs (2022), the period of “Deglobalization 3.0” is associated with the 2008 GFC and is characterized by a pronounced bifurcation of the world into two main economic blocs around the USA and China, respectively. For the USA, the retreat from globalization processes is additionally associated with protectionist measures after 2016, with the protection of jobs in the USA against global competition from China, and the subsequent trade war between the two leading countries in the period 2018-2019 (NBER, 2023).

The global Covid-19 pandemic of 2020 represents the other significant external shock (on the demand and supply sides) in international economic and political relations after World War II, which led to a refocusing of economic activities within national economies. As a result of the pandemic shock, world GDP contracted by about 3.2. % in 2020, but in 2021 it reported a growth of 5.9 % due to an increase in demand for sanitary and other goods within global value chains. Last but not least, Russia's special military operation in Ukraine in 2022 marked another external shock to international relations and a refocusing of economic and political activities on a regional basis (the so-called “friendshoring”, i.e. a predominant share of trade exchange in a limited circle of friendly countries), with the imposition of a series of restrictive measures and export restrictions by the EU and the US towards Russia and the countries of the Global South (i.e. “decoupling” or breaking off trade and other dependencies from hostile countries).

“Deglobalization 3.0” is characterized by a combination of economic nationalism and geopolitical fragmentation in the context of digital transition, a growing share of the services sector in international trade flows, concerns about environmental protection in the face of climate change, the challenges of the green transition, ensuring national security and the growing role of trade in goods with possible dual use (e.g. semiconductors, artificial intelligence, etc.). This phase of deglobalization is therefore a consequence of various forms of state dirigisme and interventionist policies, which marks the end of “Globalization 4.0” and the transition to a new “cold” war in international relations. For Bairoch (1996), structural globalization consists of a diverse type of interactive networks in the world (economic, political, social, migration, communication, etc.), as a single structure of connectivity (i.e. measured by KOF Globalization Index) and periodically goes through phases of slowing down, reaching a plateau and turning towards deglobalization.

Financial implications associated with the slowdown in globalization

In a study of possible scenarios from deglobalization (Hillebrand, 2010), which included 183 countries, the simulations in the model reached such results as: 1) A decrease in global economic growth by 1 percentage point (pp) per year, with a larger decrease assumed in non-OECD countries (i.e. by about 1.9 pp). The average income per capita for 2035 (at 2000 PPP) for non-OECD countries is expected to be $8,398 and the Gini coefficient to be 0.416. 2) Due to an increase in trade tariffs, a decline in world trade is assumed by about 2 pp per year. 3) Due to restrictions on FDIs and development aid, in non-OECD countries a decrease in GDP per capita growth is expected by about 0.2 pp. 4) Increasing poverty, social inequalities in most of the analyzed countries, probability of political instability and the outbreak of wars between countries. The probability of wars breaking out is highest in countries with autocratic regimes (20.4%), while for OECD member countries it is 0.4%. The growth of China's military power relative to the USA may result in an increase in the probability of war in the next few decades. 5) For the USA, due to a decrease in the inflow of migration by over 30 million people by 2035, a decrease in GDP of about 3% is assumed, while in the EU real GDP per capita is expected to be about 0.8 pp per year less than in the globalization scenario. Due to an increase in the probability of political instability, the largest possible decline in the GDP growth rate is predicated in China.

In the short to medium term, the “Deglobalization 3.0” phase is expected to lead to a reorganization of global supply chains (“reshoring”, “friendshoring”, etc.) with an increasing importance of bilateral/regional trade, economic and political ties. In forecasts by the Brookings Institute (2023), the average costs of severing off trade dependencies (i.e.“decoupling”) of the US from China, given the over 20% imposed trade tariffs in bilateral trade, suggest a loss of GDP for the US of over $190 billion by 2025.

In the long term, the negative consequences are expected to be much greater due to overlapping restrictions not only on trade, but also on financial flows, the growing migration flow in the world under conditions of “massive modularity” (according to Thun et al. 2022). This multifaceted complexity of production systems would create insurmountable obstacles to technological innovation and economic growth in a global perspective, especially for small, low-income countries such as Bulgaria, and would deepen social stratification and inequalities.

One of the financial implications of the slowdown in globalization is associated with increasing vulnerabilities as economies become less open due to a forced retreat from globalism, with negative impacts on the global economy. Important indicators in this respect are the change in the merchandise exports/GDP ratio, as well as the change in the KOF Globalization Index. Small open economies that have experienced large increases in their export/GDP ratios may be most affected. Middle-income countries with generally lower levels of globalization tend to benefit more from increased international economic integration than higher-income countries that are already highly globalized (i.e., with diminishing marginal returns to globalization).

The KOF Globalization Index suggests that emerging market countries have become increasingly integrated into the world economy over the past two decades. The impact of deglobalization depends on a variety of factors, including domestic policy responses and corporate sector behavior (such as the internalization of supply chains and the rebalancing of major economies like China, which are curbing investment and exports and redirecting them toward stimulating domestic consumption, so there will definitely be global losers and winners from deglobalization. It is possible that major advanced economies will refocus on their domestic markets, and this could undermine the development prospects of poorer

countries like Africa and others that hope to pursue export-oriented industrialization strategies.

Business cycles are expected to become less synchronized in a more fragmented world with trade flows likely to become more regionally concentrated, supply chains shortened, and levels of cross-border trade and investment reduced. This would negatively affect access to credit, liquidity, and increase instability in some markets and segments. Geopolitical instability is increasing the risks to global supply chains and intensifying competition between countries seeking to diversify their energy sources for production.

Diversification will become an increasingly important strategy as a result of deglobalization. National markets are becoming less vulnerable to external shocks but are exposed to internal vulnerabilities and economic conditions. National stock markets are expected to be characterized by lower returns, higher volatility, greater dispersion of returns on securities; a decrease in correlations with global indices and an increase in institutional investors' preference for local pension fund securities.

Shares listed on national stock markets would yield more reliable returns, and economic sectors with internally generated income streams (such as construction, utilities, etc.) would be more insulated from external shocks, realizing certain benefits from increased domestic investment in national supply chains. Similarly, small-cap stocks are typically less exposed to foreign demand. Export-oriented companies that are heavily dependent on global value chains may suffer the most negative consequences. With the cost of capital rising, companies with higher leverage are also expected to perform less well financially. Firms with greater flexibility in their operations are well positioned to adapt to uncertainty and changes in the environment. Investors are seeking to take advantage of regional differences resulting from protectionist policies.

Last but not least, higher inflation could make fixed-income investments (i.e., bonds) vulnerable. Bond markets would be vulnerable to potential domestic inflationary pressures and lower economic growth. Greater inflationary pressure would exert strong impact on sensitivity of domestic wages to domestic labor market conditions. The inflation outlook will also depend on exchange rate movements and domestic resource constraints, and there will be reduced synchronization of producer price inflation across countries. Potential return of capital controls would restrict local institutions from investing in foreign enterprises, with a significant impact on investor returns and reduced opportunities for portfolio diversification.

Conclusions

Deglobalization processes following the 2008 global financial crisis, the 2020 COVID-19 pandemic, and the 2022 military conflict in Ukraine are associated with a decline in connectivity between countries in international trade in goods, services, capital flows, movement of people, and technology transfer. Among the driving forces behind the slowdown in globalization processes are structural transformations in the international economic system (e.g. foreign trade, declining final value added in global value chains, increasing regulatory requirements and restrictive trade measures, cyclical factors, the growing share of services in international trade) and trends toward mass trade protectionism by leading countries such as the US and China.

Foreign direct investments have declined more rapidly than international trade in goods since 2011 in the wake of the recession following the GFC, the restrictive measures imposed on trade (for reasons of national security in sectors sensitive to countries such as energy, ICT,

robotics, AI, etc.) and the beginning of the process of "reshoring" or returning financial flows of large investment funds back to their country of origin. A number of empirical studies (including that of Stanoevic et al., 2022) point to a transition to a new paradigm of international trade with the growing role of China and its potential to generate deglobalizing effects on world trade.

The role of digitalization in the economic model based on the post-industrial knowledge society, which implies localized models of production and trade, should not be underestimated. In addition, the importance of state isolationism, especially on the part of the USA, is taken into account, with a prioritization of the focus on the domestic economic environment, escalating trade tensions globally, and imposition of new regulatory burdens to protect against climate change. In the context of delayed globalization after the “Globalization 4.0” phase (1994-2008), the main losers are expected to be countries with low per capita income, growing social instability, and high unemployment rates.

This stage of “Deglobalization 3.0” is defined as a complex combination of economic national protectionism and geopolitical decoupling from strategic trade and other dependencies on now hostile countries and a refocusing of trade flows on a regional basis ("friendshoring") with a transition to a new "cold" war in international trade, economic, and geopolitical relations.

In the wake of the deepening geopolitical and geo-economic consequences of “Deglobalization 3.0”, linked to restrictions on technological innovation and economic growth, there is a pressing need for state dirigisme and interventionist policies (Mazzucato et al., 2021) to achieve certain domestic economic and social goals related to the UN Sustainable Development Goals and Agenda 2030.

This requires the state to take on the role of an active innovative entrepreneur to correct market imperfections related to the production of global public goods (such as combating climate change, protecting the environment, green and digital transition, protecting national and intra-regional security etc.). In theoretical studies, the provision of this type of goods is threatened by two types of failures: market and state (especially in cases of a "captured" state with blocked institutional capacity, such as Bulgaria), which necessitate active international or intra-regional supranational cooperation for innovative interventions.

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FINANCIAL INSTRUMENTS USED TO SUPPORT THE GREEN TRANSITION IN ROMANIA

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Abstract

The transition to a green economy represents one of the most complex challenges of the current decades, involving profound transformations of the energy, industrial and financial sectors. The main objective of this paper is to analyze and systematize the main financial instruments that contribute to supporting the green transition, with a focus on their role in mobilizing private and public capital for sustainable projects. The study examines a wide range of mechanisms – from green bonds, sustainable loans and ESG investment funds, to innovative schemes such as blended finance and sustainability-related derivatives. The research combines theoretical analysis of the European and international framework with an empirical assessment of the efficiency of these instruments in attracting investments in renewable energy, sustainable infrastructure and energy efficiency projects in Romania. The research conclusions emphasize the importance of collaboration between financial institutions, public authorities and investors to create an ecosystem favorable to green financing. Through a comparative and multidimensional approach, the paper provides a theoretical and practical basis for improving public policies and existing financial instruments, contributing to accelerating the transition to a low-carbon economy and achieving sustainable development goals.

Keywords*: financial instruments, green transition.*

Jel classification*: G, H*

Introduction

The global green transition is emerging as an increasingly pressing imperative, driven by the climate crisis, biodiversity loss and the limits of natural resources. The literature suggests that for the Paris Agreement and the Sustainable Development Goals to be achievable, significant amounts of public and private capital must be mobilized for low-emission projects, renewable energy, sustainable infrastructure and innovative technologies (World Bank, 2022; OECD, 2021). These financial instruments, green bonds, green credits, carbon pricing

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schemes, green subsidies, are becoming essential means of correcting market imperfections, internalizing negative environmental costs and stimulating green investments (Flammer, 2020).

Globally, there is empirical evidence that green bond issuances have a positive impact on the issuer's environmental performance, although the results on financial performance are mixed (Khan, 2025). Studies also show that regulations such as the EU Taxonomy, the standardized reporting obligation and ESG criteria are becoming increasingly important in investment decisions, contributing to the credibility and transparency of green financing (Mandatory Disclosure of Standardized Sustainability Metrics, 2022).

Literature Review

From the Romanian perspective, the context is particular: the economy still has a significant dependence on fossil fuels, and coal regions are in a difficult process of reconversion (Making Romania Fit and Resilient…, 2023). In addition, the study "Financial Instruments for Decarbonization: Likely Pathways in Romania" shows that banking instruments, such as green loans, have the greatest potential to mobilize energy transformation in the country, given the structure of the national financial market, dominated by the banking sector, compared to capital markets that are still relatively small (Murafa, 2023).

Another important reason for Romania is the need to increase the level of awareness and adoption of green financial products. A comparative study between Poland and Romania indicates that, although interest is relatively high in both countries, the level of awareness and knowledge of green instruments is lower in Romania (Siemionek-Ruskań et al., 2022). This limits the ability of local companies and banks to develop sophisticated green products and benefit from the support of European policies. Furthermore, recent literature shows that in Romania, green loans granted by financial institutions present a lower credit risk compared to conventional loans (Neagu, 2024). This difference suggests that green financial instruments can not only be environmentally efficient, but can also have advantages in terms of financial stability, which makes them more attractive for the domestic financial system.

In conclusion, the topic of financial instruments for the green transition is essential both globally for achieving climate goals, for mobilizing capital and regulation, and in Romania for adapting the economic structure, exploiting the potential of the banking sector, improving awareness, and managing regional and social equity. Studying this topic provides policymakers with solid data and recommendations for projects, regulations, and strategies that will make the green transition not just wishful thinking, but a practical reality.

Methodology and Data

The methodology of this research is based on a mixed qualitative and quantitative approach, aiming to analyze the financial instruments used to support the green transition and assess their impact globally and in Romania. This methodological combination allows the integration of both theoretical and institutional perspectives, as well as empirical and statistical data (Creswell & Plano Clark, 2018).

A first methodological step is the documentary and literature analysis, by examining academic articles published in prestigious international journals, reports of international organizations (World Bank, OECD, IMF, European Commission), as well as studies applied to Romania. This analysis aims to identify the main types of green financial instruments

(bonds, loans, transition funds, carbon taxes) and to capture how they are used to support decarbonization objectives (Flammer, 2020; Khan, 2025).

Secondly, the research uses comparative analysis to assess international experiences in the use of green financial instruments and relate them to the case of Romania. For example, studies show that developed markets in Western Europe have a high level of green bond issuance, while Romania is still at an early stage, based mainly on green loans and European structural funds (Murafa, 2023; Siemionek-Ruskań et al., 2022). This method allows highlighting gaps and opportunities for the development of the Romanian green market. A third stage is the application of a quantitative analysis based on available statistical data.

The research will use data from the National Bank of Romania, Eurostat and the World Bank on the volume of green loans, green bonds and transition funds attracted in Romania. For example, the comparative analysis of green and conventional bond yields or the credit risk of green loans provides indications on the attractiveness and sustainability of these instruments (Neagu, 2024). The methodology also includes a case study applied to Romania, targeting the Just Transition Fund and its impact on mining regions such as Banatul Montan and Valea Jiului. This case study allows for understanding how financial instruments support the transition at regional level and how good practices identified in other EU Member States can be replicated (IMF, 2023; World Bank, 2022 and 2023).

To complete the analysis, the research will also integrate an exploratory component based on interviews with experts from the financial sector (commercial banks, NBR, Ministry of Finance) and representatives of local authorities from the regions targeted by the green transition.

This qualitative approach provides a direct perspective on the obstacles and opportunities identified by practitioners, complementing the statistical and theoretical analysis (Creswell & Creswell, 2017). The proposed methodology is therefore integrated, combining documentary analysis, comparative analysis, quantitative data evaluation, case studies and qualitative research, to ensure a complex and applied understanding of how financial instruments contribute to supporting the green transition, both globally and in Romania.

Results

A first expected scientific result of the research consists in identifying and systematizing the main green financial instruments used at global and national levels, such as green bonds, green credits, transition funds and carbon taxes. T

his contribution is relevant because the specialized literature emphasizes the lack of a unitary taxonomy and a homogeneous classification of these instruments, which creates difficulties in the comparative analysis of their impact (Flammer, 2020; OECD, 2021). Thus, the research will bring value by developing a conceptual framework applicable both in international analysis and in the case of Romania.

Table 1: Identifying and systematizing the main green financial instruments.

Green Financial Instrument	Definition / Objective	International Level	National Level (Romania)	Examples / Source
Green Bonds	Debt securities issued to finance sustainable projects	Highly developed market (USA, EU)	Emerging market (first issuance 2021 Ministry of Finance)	Flammer (2020), OECD (2021)
Green Loans	Loans granted for low-carbon investments	Mainly banking in Asia/Europe	Growing portfolio at BCR, BRD, Raiffeisen	Neagu (2024)
Transition Funds	Funds dedicated to sectors in transition	EU Just Transition Fund	Just Transition Mechanism in mining regions	IMF (2023)
Carbon Taxes	Taxes applied to GHG emissions	Implemented in 40+ countries	At discussion stage (extended ETS)	OECD (2021

Source: Flammer (2020), OECD (2021), Neagu (2024), IMF (2023).

A second expected result is the assessment of the impact of financial instruments on environmental performance and financial stability. Existing studies show that green bonds are associated with improved ESG indicators, but the results regarding financial returns and risks are mixed (Khan, 2025). In the case of Romania, recent research has demonstrated that green loans present a lower credit risk compared to conventional ones (Neagu, 2024). This finding suggests that the research can contribute to strengthening the empirical evidence on the benefits of green financial instruments also in the context of an emerging economy.

Table 2: Financial instruments on environmental performance and financial stability

Instrument	Impact on Environment	Impact on Financial Stability	Findings from Literature
Green Bonds	+ ESG indicators, emissions reduction	Mixed results regarding returns and risk	Khan (2025)
Green Loans	+ Sustainable investments	Lower credit risk vs. conventional loans	Neagu (2024)
Carbon Taxes	Emissions reduction	May affect sector competitiveness but increases fiscal revenues	OECD (2021)

Source: Khan (2025), Neagu (2024), OECD (2021).

Another anticipated outcome is the comparative analysis between international and Romanian experiences, which will allow highlighting gaps and good practices.

For example, the literature shows that in Western Europe capital markets play a central role in financing the transition, while in Romania the banking sector is dominant, which limits the diversity of available instruments.

Therefore, the research will make an original contribution by relating the Romanian situation to the European and global context.

Table 3: Comparative analysis between international and Romanian experiences

Compared Element	Western Europe / Global	Romania
Dominant actor	Capital markets (funds, green bonds)	Banking sector (green loans)
Instrument diversity	High (ETS, carbon taxes, mature green bonds)	Low (green bonds at early stage, carbon taxes incipient)
Regulation & standards	EU taxonomy clear, international standards	Partial alignment, lack of full mechanisms
Good practices examples	France – large green bond issuance; Germany – extended ETS	Just Transition Fund, green loans with lower risk

Source: Processed from literature and institutional reports.

An important outcome will be the assessment of the social and regional dimension of the green transition. International literature emphasizes that just transition represents a major challenge, as the costs of decarbonization are unevenly distributed (World Bank, 2022). In Romania, mining- dependent regions, such as Banatul Montan and Valea Jiului, face major social risks, and financial instruments such as the Just Transition Fund can provide solutions for economic reconversion (IMF, 2023). The research will contribute to a deeper understanding of how these instruments can support equity and social cohesion.

Table 4: Evolution of green financial instruments

Romanian Region	Social Challenges	Available Instruments	Research Relevance
Valea Jiului	Loss of mining jobs	Just Transition Fund	Case study for just transition
Banatul Montan	Need for economic reconversion	EU training programs and grants	Example for social equity

Source: Processed from literature and institutional reports from this regions.

Last but not least, it is expected to provide applicable recommendations for strengthening the institutional and financial framework in Romania. Compared to previous research, which mainly addressed theoretical and descriptive dimensions (Flammer, 2020; OECD, 2021), the present research will provide results adapted to the Romanian specifics, integrated into the current economic reality. This aspect is particularly relevant for decision-makers and the financial sector, which need to align existing instruments with the requirements of the European Green Deal and the objectives of climate neutrality by 2050.

Table 5: Recommendations for strengthening the institutional and financial framework in Romania

Recommendation Area	Proposed Measures
Instrument diversification	Develop the sovereign and corporate green bond market
Social integration	Extend just transition mechanisms for vulnerable regions
Regulation & transparency	Adopt a national taxonomy compatible with the EU one
Financial stability	Continue empirical studies on risks and returns of green instruments

Conclusions

The analysis of the financial instruments used to support the green transition in Romania highlights the crucial role of green bonds, sustainable loans and transition funds in mobilizing the necessary capital. While developed markets rely on the diversification of instruments, Romania is still dependent on the banking sector. The results suggest that improving the legislative framework, increasing awareness and accelerating the development of capital markets are essential. Moreover, the social and regional dimension of the transition cannot be neglected, and the Just Transition Fund represents a positive example of an instrument adapted to the national context. Thus, an integrated approach, based on cooperation between institutions, public authorities and investors, is fundamental to accelerating the transition to a green economy.

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SECTION III. SUSTAINABLE DEVELOPMENT AND INCLUSIVE ECONOMIC GROWTH

PRICE FORMATION IN THE INFORMATION ECONOMY: SPECIFIC FEATURES OF THE INFODOCUMENTARY MARKET

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Abstract:

Neoclassical growth models conceptualize knowledge as a private good subject to the rules of perfect competition. However, this perspective raises questions regarding the specificity of information and the limits of conventional market mechanisms in the knowledge domain. While classical production factors are consumed in the production process and recovered through the market realization of outputs, information and knowledge do not follow these standard patterns. Information integrated into production contributes anticipatively to achieving outcomes (feed-forward) without being consumed. It functions analogously to a catalyst: it facilitates transformations within the production process yet remains intact and can even increase in value through its use. Unlike classical economic markets, where demand and supply pertain to the same entity, the info documentary market is characterized by a structural disjunction: demand targets knowledge, whereas supply provides information. The defining feature of this market, without parallel in standard economic theory, lies in the existence of two equilibrium points, corresponding to two distinct transaction prices.

Keywords: *information, knowledge, user, infodocumentary market, price of information*

JEL classification: *D83, L86, O33*

Introduction

The contemporary economy is undergoing a process of profound structural transformation, driven by the shift from an industrial paradigm to one based on information, knowledge, and technology-assisted intelligence. In recent decades, a new type of economic system has emerged - often referred to as the information economy or knowledge economy - in which

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information and the ability to transform it into applicable knowledge become the main factors of production. (Machlup, 1962; Drucker, 1993; Castells, 1996).
This fundamental shift is redefining not only the dynamics of traditional markets, but also the role of information and documentation institutions-libraries, information centers, digital archives, and scientific platforms - which are increasingly acting as cognitive infrastructures of society(Bell, 1973; Nonaka & Takeuchi, 1995). In this context, information is no longer just a public good or a simple flow of data, but a strategic asset, subject to economic mechanisms of production, circulation, and exploitation(Stiglitz, 2000; Shapiro & Varian, 1999).
The emergence of artificial intelligence (AI) as a cognitive tool for processing and augmenting information is accelerating this trend. Assisting information processes through generative algorithms and semantic models expands human capacity to access, interpret, and create knowledge, radically transforming information ecosystems. (Brynjolfsson & McAfee, 2017; Floridi, 2020). From an information management perspective, AI does not replace human functions, but rather reconfigures the processes of organizing, filtering, and evaluating information, facilitating the transition from passive management of documentary resources to dynamic knowledge management(Nonaka, Toyama & Konno, 2000).
Therefore, we are witnessing the emergence of a new type of market - the infodocumentary market - where the interaction between supply and demand is based on the symbolic, cognitive, and technological value of information. Unlike material goods, information has distinct economic properties: it is unlimited in reproduction, difficult to exclude through consumption, but dependent on the epistemic context in which it is used(Arrow, 1971; Varian, 1998). This dual nature - public and private - creates conceptual challenges in defining the price, value, and utility of information.

The purpose of this article is to analyze the mechanisms through which information, as a fundamental resource of the knowledge economy, is transformed into a commodity, with a price and value determined by cognitive, technological, and institutional interactions. In an interdisciplinary manner, the analysis combines concepts from Knowledge Management theory, an intersecting field that is part of both Information Economics and Library and Information Science (ILS), highlighting how information and documentation structures participate in the processes of information production, distribution, and valorization.

More specifically, the article explores how the price of information is influenced by factors such as cognitive scarcity, contextual relevance, technological accessibility, and institutional intermediation. It also analyzes the role of AI in shaping these processes, highlighting the emergence of a hybrid economy in which humans and algorithms cooperate in the formation of informational value (Bengio, 2023).

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Theoretical framework

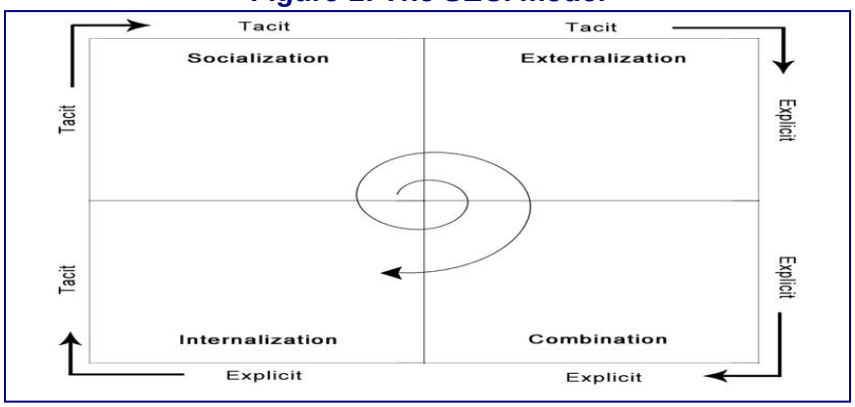
The fundamentals of Information Economics and Knowledge Management Theory applied in the infodocumentary space have their origins in the structural transformations of post-industrial capitalism. Since the mid-20th century, the global economy has begun to rely not only on physical capital and labor, but also on information as an essential factor of production, comparable in importance to material resources. (Machlup, 1962; Porat, 1977). Fritz Machlup is considered the conceptual pioneer of the knowledge economy, arguing that

sectors based on the production, processing, and transmission of information constitute an increasingly significant part of national GDP(Machlup, 1962).

At the same time, neoclassical macroeconomic approaches began to integrate the role of information into endogenous growth models. Robert Solow (1956) hypothesized that technological progress, often implicitly informational, is the major determinant of long-term economic growth. Subsequently, Romer (1986) and Lucas (1988) demonstrated that knowledge, accumulated through education, research, and innovation, is a public good with increasing returns, capable of sustaining economic development without material constraints.
This paradigm shift was reinforced by the works of Bell (1973), Drucker (1993), and Castells (1996), who described the emergence of the "post-industrial society" and the "network society," in which information becomes the central element of economic and social organization. While in the industrial economy value came from the transformation of matter, in the information economy value derives from the transformation of symbols, i.e., from cognitive and communicational processes (Bell, 1973; Castells, 1996).
From a microeconomic perspective, Arrow (1971) showed that information has distinct properties compared to traditional goods: it is not rival in consumption, its reproduction has zero marginal cost, and its value depends on the decision-making context. Once information is disclosed, it cannot be "retracted"- which makes it an atypical good from a market perspective. Therefore, information asymmetries (the differences between what the seller knows and what the buyer knows) generate structural imbalances in economic transactions (Akerlof, 1970).
The information economy thus becomes a theory of market imperfections, and the value of information is defined not by scarcity, but by relevance and timeliness. According to Stiglitz (2000), information has no intrinsic value, but rather a derived value resulting from its ability to reduce uncertainty and incompleteness, thus leading to improved economic decisions. In this sense, the price of information reflects not the cost of production, but the marginal utility associated with the decision-making process.

Within knowledge management theory, these ideas are developed by Nonaka and Takeuchi (1995), who define knowledge as a process of conversion between tacit forms (experience, intuition, competence) and explicit forms (documents, data, information). The SECI model (Socialization – Externalization – Combination – Internalization) describes the cycle through which organizations transform information into applicable knowledge, generating sustainable competitive advantages. Davenport and Prusak (1998) complemented this perspective, showing that the value of knowledge in an organization derives from context, experience, and interpretation- not just from the accumulation of data.

Figure 1: The SECI model



Source:Nonaka & Takeuchi (1995)

Applying these concepts to the ILS domain involves two dimensions: an economic one (related to the market value of information) and an epistemological one (related to the value of truth and cognitive relevance). Libraries, archives, and databases act as intermediaries between these dimensions, transforming raw information flows into structured, validated, and accessible knowledge (Wilson, 1981; Buckland, 1991).
Furthermore, with the accelerated digitization of scientific communication, information has simultaneously become an economic and social good. The digital economy of information, analyzed by Shapiro and Varian (1999), introduces concepts such as "differentiated access prices," "network effects," and "information goods with zero marginal costs." In this context, the value of information is determined not only by its content, but also by the structure of the system that disseminates it.

Similarly, Polanyi's (1966) contribution regarding the distinction between tacit and explicit knowledge provided library science with a conceptual framework for understanding the limits of comprehensive documentation. An essential part of knowledge remains inherently undocumented, transmitted only through practice and social interaction. In the digital economy, artificial intelligence attempts to model precisely these intermediate spaces - by extracting regularities, inferences, and semantic relationships from massive data sets.

Thus, AI becomes an epistemological tool, not just a technological one: a "cognitive assistant" that expands the capacity to organize and interpret information. Floridi (2020) proposes the term infosphere to describe the global information ecosystem in which humans and machines co-evolve cognitively. Within this infosphere, libraries and information and documentation institutions are no longer mere data repositories, but nodes of interaction between human knowledge and artificial knowledge (Brynjolfsson & McAfee, 2017; Bengio, 2023).

Therefore, the theoretical framework of the modern information economy is based on the convergence of three traditions:

1. The knowledge economy, which treats information as a factor of production (Machlup, 1962; Romer, 1986; Lucas, 1988);
2. Knowledge management theory, which describes the processes of conversion between information and learning (Nonaka & Takeuchi, 1995; Davenport & Prusak, 1998);
3. Digital librarianship, which investigates the institutional infrastructures of information circulation (Buckland, 1991; Floridi, 2020).

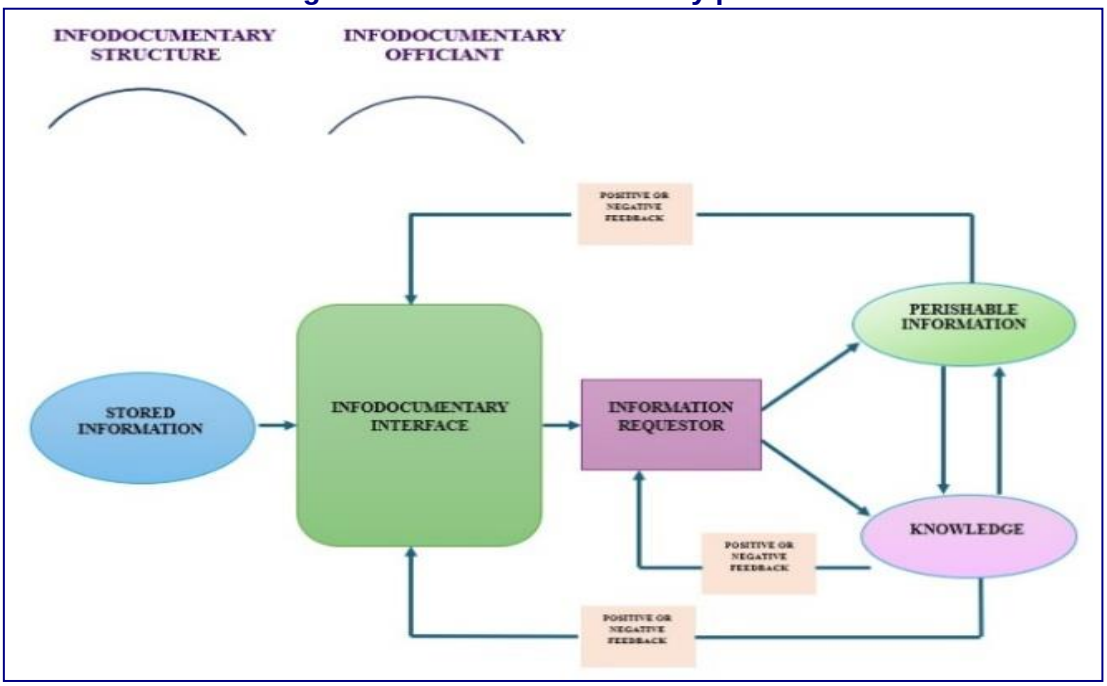
In summary, information is no longer just a product of human activity, but an active link in the value chain of the global economy. The role of information and documentation institutions is to ensure the epistemic continuity of this economy by validating, contextualizing, and democratizing access to knowledge.

The infodocumentary market

The concept of the information market refers to the set of economic, technological, and institutional relationships through which information, in structured form, is produced, disseminated, and exploited. It includes both direct commercial flows (publishers, databases, information services) and non-profit or public structures that facilitate free access to knowledge (libraries, archives, academic repositories). Unlike traditional markets for material goods, the information and documentation market operates with an intangible, cumulative, and self-reproducing resource: information (Shapiro & Varian, 1999).

The infodocumentary market operates on the basis of the infodocumentary process, an essential mechanism through which the applicant acquires knowledge based on the information provided by the infodocumentary officer. This process is not just a simple transmission of information, but a complex, circular, and self-regulating system in which the interaction between the information infrastructure, the infodocumentary interface, and the user generates cognitive value.
The starting point of the process is the infodocumentary structure, i.e., the set of institutions, technological systems, and organizational mechanisms through which information is stored, structured, and preserved. In this context, the infodocumentary officiant plays an essential intermediary role, ensuring the user's access to relevant, current, and validated information resources. The infodocumentary interface is the space of mediation between the system and the requester, facilitating the transmission of stored information to the end user.

Figure 2: The infodocumentary process



Source: authors

The information requester - an active component of this process - formulates the information need and, through the interface, accesses the available information. This information may be perishable, i.e., irrelevant to the requester, or it may constitute information that is transformed into knowledge due to its compatibility with the subject's cognitive background. Through a process of assimilation, interpretation, and cognitive integration, information becomes knowledge, thus fulfilling the fundamental purpose of the infodocumentary market: transforming information into intellectual value.
An essential element of this mechanism is feedback - positive or negative - which can occur between all components of the process: between the requester and the interface, between the interface and the information infrastructure, or between perishable information and the system. This feedback ensures the continuous adjustment of content, access procedures, and informational relevance, thus contributing to the efficiency and sustainability of the process.

Therefore, the infodocumentary process is not a linear flow, but an interactive and self-regulating system in which the roles of producer, intermediary, and user of information are interconnected. It underpins the functioning of the infodocumentary market, ensuring not only the transmission of information, but also the production of knowledge in an epistemic, economic, and social sense.
This structural and functional dynamic of the infodocumentary process is directly reflected in the way the infodocumentary market is organized and operates. The internal characteristics of the process - interactivity, self-regulation, and dependence on information infrastructures—generate a series of economic, technological, and institutional features that differentiate this market from other traditional markets for goods or services.
The infodocumentary market is unique from at least three perspectives: (1) the specific economic nature of information, (2) the role of information and documentation infrastructures in guaranteeing access, and (3) the effect of technological transformations on the value and distribution of information.

The economic nature of information

Information has characteristics that radically differentiate it from physical goods. It is non-rivalrous (consumption by one individual does not exhaust it) and non-exclusive (it is difficult to restrict access once it has been published) (Arrow, 1971). For this reason, information markets tend to generate free copying and positive externalities, which undermine traditional pricing logic.
Economists have noted that information has a dual nature: it is both a public good and an economic good (Stiglitz, 2000; Varian, 1998). This duality gives rise to the structural tension of the information-documentation market: how can a price be assigned to a good whose value increases with the degree of dissemination? Paradoxically, information becomes more valuable as it circulates, but more difficult to monetize.
In library science terms, the value of information is defined not only by its content, but also by its contextual relevance and access time (Buckland, 1991). Perishable information, such as market data or economic news, has a high short-term value, but it decreases rapidly. In contrast, academic or cultural information can accumulate symbolic value over time, becoming part of a community's cognitive capital (Putnam, 2000).

Information and documentation institutions as market infrastructures

Libraries, archives, and information centers play an intermediary role between producers and users of information, ensuring a balance between the economic and social logic of knowledge. They are, in essence, trusted infrastructures - spaces where information is validated, classified, and made accessible (Wilson, 1981; Line, 1998).
From the perspective of the knowledge economy, these institutions contribute to reducing the transaction costs associated with informational uncertainty (Williamson, 1985). An efficient library system minimizes the risks related to the quality and veracity of information, providing users with epistemic and ethical guarantees. In other words, libraries function as mechanisms for correcting the information market, compensating for the imperfections generated by asymmetries and information monopolies (Stiglitz, 2000).
In the digital age, this role extends to the field of open access and open science, where information and documentation institutions become mediators between the demands for democratization of information and the economic constraints of commercial publishers (Suber, 2012). This intermediary position is often delicate, as it involves balancing public interest with financial sustainability.

Digital dynamics and the emergence of the hybrid market

Technological progress and digitization have radically transformed the mechanisms of information production and circulation. While the classic library model focused on collections, the digital economy shifts the emphasis to connectivity and interoperability (Castells, 1996; Floridi, 2020). The information and documentation market is becoming a platform market, where access to information is mediated by complex technological infrastructures - scientific databases, search engines, content aggregators, recommendation algorithms.

This transformation generates a new type of value: algorithmic value. Information is no longer valued solely for its content, but for the way it is processed and delivered to the user (Brynjolfsson & McAfee, 2017). In this sense, artificial intelligence acts as an emerging economic actor, actively participating in the structure of the information and documentation market. Generative models, such as those used in cognitive assistance systems, can select, synthesize, and recombine information, creating derivative forms of knowledge with autonomous economic value (Bengio, 2023).

This hybrid information economy, in which humans and algorithms collaborate in the process of producing and disseminating knowledge, raises essential ethical and epistemological questions. To what extent can algorithmically generated knowledge still be considered authentic, scientifically validated, and socially responsible? Floridi (2020) argues that we need to develop an ethics of the infosphere, capable of integrating the principles of transparency, accountability, and sustainability into the governance of data and knowledge.

At the same time, the increase in the commercial value of data- especially user data - has led to the emergence of a secondary market for personal information, where data becomes a currency for digital services (Zuboff, 2019). This market, dominated by global platforms, produces new forms of information asymmetry and concentration of economic power, calling into question the neutrality of information infrastructures.

Symbolic value and cognitive capital

Beyond its economic dimension, information also has a symbolic value associated with recognition, prestige, and intellectual authority. In academia, this value is manifested through indicators such as impact factor, citations, or international indexing, which function as mechanisms of validation and indirect monetization (Bourdieu, 1986; Merton, 1973).

Libraries and archives contribute to the preservation of this symbolic capital, ensuring the continuity of knowledge through selection and archiving. In the digital age, this function takes on a new dimension: preservation no longer means just the physical storage of documents, but also maintaining sustainable access to digital formats, metadata, and interpretation interfaces (Buckland, 2018).

Thus, the infodocumentary market can be understood as a complex system of production, validation, and circulation of knowledge, in which the value of information is determined simultaneously by its economic utility, its cognitive relevance, and the institutional authority that supports it.

Price formation mechanisms

Determining the price of information is one of the most challenging topics in contemporary economics, as information eludes traditional economic evaluation criteria. In the information and documentation market, value and price no longer reflect only production costs, but also intangible dimensions such as cognitive relevance, source credibility, timeliness, technological accessibility, and the degree of algorithmic mediation (Stiglitz, 2000; Shapiro & Varian, 1999).

The paradox of information value

The first paradox lies in the fact that information reveals its value only after it is known. Arrow (1971) observed that "the value of information lies in what could be gained by possessing it, but in order to evaluate it, we must first possess it." For this reason, establishing an equilibrium price becomes problematic. The buyer cannot know the exact value of the information before purchasing it, and the seller cannot sell it without revealing it. This fundamental asymmetry leads to the emergence of alternative forms of pricing: subscriptions, temporary licenses, metadata-based access, or pay-per-use (Varian, 1998).
In the scientific publishing market, these models are evident: access to databases (Elsevier, SpringerLink, ProQuest, etc.) is often conditioned by institutional packages, which reflect not only the volume of information, but also the added value generated through filtering, classification, and validation. In other words, the price does not refer to raw information, but to the integrated cognitive service - to "documented information" (Buckland, 1991).

The economic and epistemic component of price

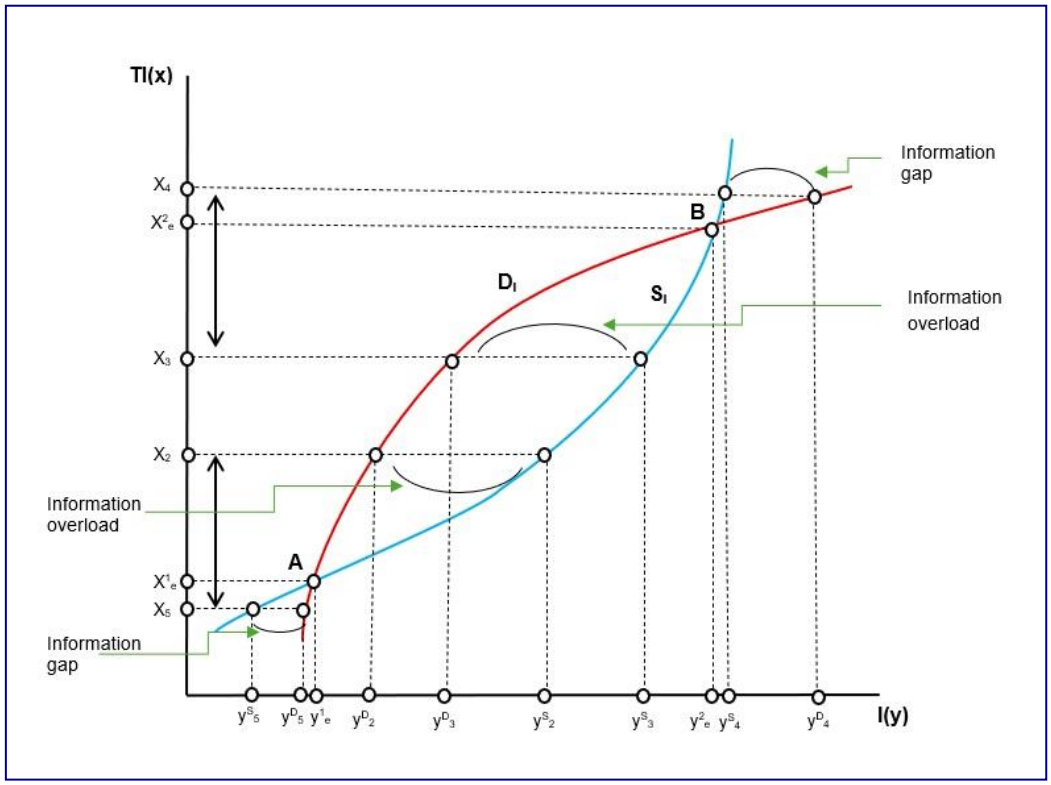
Within the information market, the price of information can be broken down into two interdependent components:
1.The economic component, which reflects the costs of production, digitization, storage, maintenance, and access.
2.The epistemic component, which reflects the cognitive value of information - the degree of originality, relevance, scientific validity, and practical utility.
The first component is quantifiable and based on traditional economic parameters. The second is emergent and contextual, dependent on interpretation processes and the purpose of use (Nonaka & Takeuchi, 1995). In a dynamic knowledge system, information changes its value as the scientific or technological paradigm changes.
For example, a set of bibliographic data may be relatively inexpensive in terms of information volume, but extremely valuable when semantically correlated by artificial intelligence algorithms that extract hidden relationships between authors, concepts, and domains (Bengio, 2023). Thus, AI contributes directly to the generation of epistemic value, transforming inert information into operational knowledge.

Non-monetary mechanisms of the information market: ideal capital and time as price

The structural difference between the nature of demand and supply, within a possible economic theory of information and knowledge, makes it difficult - if not impossible - to discuss the concept of equilibrium in the standard sense of the information and documentation market. At first glance, this particularity might suggest that we are not dealing with a market per se, at least not in the sense established by economics textbooks. Consequently, a conceptual clarification is needed, whereby the infodocumentary market is defined in specific terms that emerge from the present research.
In this context, the object of the transaction is the information provided by information and documentation structures. The demand for information is formulated by the library science requester (SI), and the supply is represented by the official of the respective structure (OI). Unlike the standard economic market, where multiple demands and offers meet on the same good or service, in the library science market, interaction focuses on unique demands and offers related to the same information. From a theoretical point of view, information should be understood as an intermediate good, not a final one. It is "acquired" to be transformed into a superior cognitive product, which is, in fact, the final consumer good. In this logic, the information provided approaches the status of a capital good. However, it is not material capital, but ideal capital, devoid of materiality, but endowed with virtuality and transformative potential.

Thus, the infodocumentary market can be defined as the market of ideal capital, where the object of the transaction is information. The mechanism of adjustment between supply and demand no longer follows the traditional logic of monetary price. Instead, the "price" is expressed in terms of the time invested by the actors involved in the process. Both the requester (SI) and the officiant (OI) consume part of their lifetime for the transaction to take place. Since time is the fundamental basis for measuring economic value, it follows that the transaction price in the library market is temporal, not monetary. Equilibrium is achieved when the time that each party is willing to "spend" is harmonized through a process of trial and error and negotiation. In this sense, the transaction price coincides with the equilibrium price specific to the information and documentation market, expressed not in money but in time (Dinga, 2022).

Figure 3: Transaction price formation on the infodocumentary market



Source: authors

Figure 3 summarizes the mechanisms of the information market, where the transaction price is expressed by IT – information time, i.e., the time that the information seeker (IS) and the information provider (IP) are willing to invest in order to complete the exchange. The demand for information($\boldsymbol{D}_{\mathrm{I}}$, red and concave curve) and supply ($\boldsymbol{SI}$, green and convex) are expressed graphically according to economic theory conventions, with price (independent variable) on the y-axis and quantity of information (dependent variable) on the x-axis. The fundamental feature is that both curves are increasing: demand has a concave shape (increased cognitive yield over time), and supply has a convex shape (gradual decrease in informational novelty). This asymmetry generates two equilibrium points:
A ($x_e{}^1$, $y_e{}^1$) – low level of access, associated with intellectual profiles with limited objectives;
B ($x_e{}^2$, $y_e{}^2$) – high level of access, specific to intellectual profiles with broad objectives.

Between these two points, information surpluses or deficits may arise. The deficit is corrected by increasing access time, while the surplus, paradoxically, is also resolved by allocating additional time, which allows for a finer balance between supply and demand.
Consequently, the infodocumentary market does not reproduce the standard mechanisms of economic equilibrium, but functions as an ideal capital market, where adjustment is achieved through negotiation and capitalization of the time invested.

The role of artificial intelligence in information assessment

Artificial intelligence introduces a new dimension to information pricing: the ability to automatically assess relevance and credibility. Semantic models and deep neural networks can analyze the volume and quality of information on a massive scale, implicitly determining its value for use (Brynjolfsson & McAfee, 2017).
Thus, algorithms not only organize information, but also actively participate in its evaluation—establishing the order of search results, the degree of visibility, and even the symbolic prestige of sources (Floridi, 2020). In this sense, the price of information is no longer just an economic quantity, but also an algorithmic one, dependent on the internal logic of recommendation and filtering models.
This situation generates what we might call an algorithmic information market, where value is formed through a process of co-evaluation between humans and machines. AI functions as a validation mechanism based on statistical regularities but lacking epistemic consciousness. Therefore, although it contributes to efficiency, the algorithmization of information value risks replacing criteria of scientific relevance with those of popularity or visibility (Zuboff, 2019).

Conclusions

The infodocumentary market is an emerging space in the knowledge economy, where the dynamics of value and price are governed not only by economic laws, but also by epistemic, technological, and symbolic mechanisms. In this market, information is simultaneously a commodity, infrastructure, and process—a resource that changes its status depending on the context of use and the level of cognitive integration.

The analysis showed that the transformation of information into knowledge cannot be reduced to a simple technological conversion, but involves complex mediation between the individual, the institution, and technology (Nonaka & Takeuchi, 1995). In this process, libraries, documentation centers, and digital platforms are not just intermediaries, but cognitive architectures that ensure the validation, contextualization, and distribution of knowledge. The role of AI is ambivalent: on the one hand, it optimizes the search, classification, and recommendation of information, increasing the efficiency of documentation processes; on the other hand, it risks replacing traditional scientific evaluation with algorithmic criteria of visibility and popularity (Floridi, 2020). In this sense, the challenge of the future is not only technological but also axiological: how can we ensure that algorithms serve knowledge, not just information consumption?

Theoretically, the article argues for the need for a hybrid model of information evaluation that integrates the economic dimension (costs, scarcity, demand), the epistemic dimension (relevance, validity), and the algorithmic dimension (accessibility and digital filtering). Only such an approach can reflect the complex reality of the information market, where price is a function of cognitive value, and value derives from collective processes of validation and dissemination.

In practical terms, the results can contribute to the development of public policies in the field of access to information, the regulation of artificial intelligence in the documentary sector, and the reconfiguration of the role of libraries as institutions of cognitive balance between science, economy, and society (Buckland, 2018; Drucker, 1993).

Looking ahead, future research should explore three major directions:

1. Methods for ethical algorithmic evaluation of information, balancing relevance with epistemic diversity;

2. Cognitive value indicators capable of integrating qualitative aspects into economic models;

3. Institutional models of partnership between humans and AI, in which artificial intelligence functions as a tool for augmentation, not substitution, of human judgment.

4. In conclusion, the infodocumentary market is emerging as a new epistemological laboratory of the contemporary economy. It reflects the tensions between knowledge and capital, between algorithm and consciousness, between access and monopoly. In this space, artificial intelligence is not just a technological tool, but a cognitive actor that redefines the boundaries of value.

The information economy, as it appears today, thus becomes an economy of meaning, where price is no longer the measure of value, but only the echo of a continuous competition for significance (Machlup, 1962; Romer, 1986; Castells, 1996).

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EXPLAINING ONLINE PURCHASES IN THE EUROPEAN UNION: A COUNTRY-LEVEL PERSPECTIVE

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Abstract:

This paper investigates the determinants of online purchases in the European Union using annual country-level data for 2020–2023. We focus on macroeconomic (GDP per capita, inflation, consumption share), institutional (regulatory quality), technological (internet penetration, broadband subscriptions), and demographic (share of population aged 65+) factors. Our estimates show that income, regulatory quality, and internet use are strongly and positively associated with online shopping, while consumption share is negatively related. Inflation exerts a modest positive effect, and ageing unexpectedly supports digital uptake. The findings highlight that online purchases depend not only on technology but also on income, institutions, and demographics. We bring an EU-wide update for 2020–2023 and show which country-level factors move with online buying. We also flag a measurement gap: fixed lines are a weak stand-in for day-to-day retail connectivity, so future work should add mobile metrics (4G/5G coverage, typical downlink, data affordability).

Keywords: *online purchases, European Union, digital infrastructure, ecommerce*

JEL classification: *D12, L81, O52, E31*

Introduction

The growth of online purchases has become one of the most visible transformations in consumer behavior in the European Union during the last decade. Differences in income levels, digital infrastructure, regulation and demographics across member states explain why some countries have advanced much faster than others in adopting ecommerce. Studying these determinants at the country level helps policymakers reduce the digital divide within the Union and allows companies to adjust their market strategies more effectively. Firms that understand these dynamics can design marketing campaigns and investment decisions that match the realities of national markets rather than assuming a uniform European consumer.

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The COVID-19 pandemic acted as a catalyst for the adoption of online shopping. Lockdowns and restrictions on physical mobility pushed consumers to rely heavily on digital channels, while firms were forced to strengthen their ecommerce platforms to survive. The intensity of this shift was not the same everywhere. In countries with better infrastructure and high internet penetration the transition was smooth and created lasting habits, while in other places the process revealed gaps in digital inclusion and limited access for parts of the population.

After the pandemic new shocks reshaped consumer choices and firm strategies. The energy crisis that began in 2021 and the geopolitical uncertainty caused by the war in Ukraine raised inflation and reduced household purchasing power. These conditions made consumers more attentive to prices and often encouraged them to look for cheaper products online. At the same time companies faced supply chain disruptions and responded by strengthening their digital channels in order to reach customers more directly. Online shopping became more than a matter of convenience. It turned into a way of coping with uncertainty and rising costs which makes it even more important to study its determinants in the European context.

In this paper we investigate the main country level factors that explain the share of online purchases in the European Union during the period 2020 to 2023. The analysis considers macroeconomic indicators such as GDP per capita and inflation institutional variables such as regulatory quality, technological factors such as internet penetration and broadband subscriptions, as well as demographic characteristics such as the share of the population over sixty-five. The objective is to provide evidence on which structural conditions matter most for the diffusion of online shopping in Europe and to draw implications both for policymakers and for firms that operate in the digital marketplace. Our goal is explanatory rather than causal: we document robust associations between country-level drivers and online purchasing, based on comparable EU statistics.

Literature Review

Studies on online shopping often talk about how important information flows and digital channels are in shaping what people buy.

More and more people are adopting EU. Eurostat says that in 2014, 59% of people aged 16 to 74 bought things online. By 2024, that number had risen to 77%. In 2023, 23.8% of EU companies sold things online, and e-sales made up about a fifth of their total sales. All of these trends together make it possible for us to do our country-level analysis (Eurostat, 2024; Eurostat, 2025).

Chen et al. (2024) demonstrate that various information sources, including the internet, broadcasting, print media, and word of mouth, affect household expenditures on tourism, culture, and entertainment. Their findings underscore that the digitalization of information sources diminishes information asymmetry and fosters social interaction, thereby augmenting consumers' propensity to engage in online purchases. These insights indicate that transparency and accessibility to digital information are essential prerequisites for the growth of e-commerce.

Another area of research looks at how financial and digital inclusion change how people shop. Hu et al. (2022) discover that digital finance promotes household acquisition of insurance products by enhancing financial literacy and facilitating access to online financial services, especially among low-income and rural households. Zhu and Li (2025) further this research by examining how the digital divide in access, usage, and utility limits households' likelihood of acquiring commercial insurance. They contend that trust, social interaction, and

service accessibility can alleviate these obstacles. When looked at together, these studies show that digital infrastructure and inclusiveness are very important factors that affect how people shop online.

Structural and regional factors significantly influence e-commerce adoption. Lola and Bakeev (2023) examine regional disparities in Russia, revealing that the proliferation of online shopping is facilitated by the utilization of computers and smartphones, as well as elevated regional income; however, a pervasive distrust in digital platforms continues to pose a significant challenge. In another study, Konus et al. (2014) show that taking away a traditional sales channel like printed catalogs can make people buy things online instead and even make their orders bigger. Both contributions affirm that the adoption of e-commerce is contingent not only upon technology and income but also on the degree of consumer trust and the configuration of available sales channels.

Recent studies underscore the significance of innovation, macroeconomic stability, and consumer behavior within the European context. Wójtowicz et al. (2024) contend that nations characterized by elevated innovation levels demonstrate an increased propensity for online shopping and more sustainable consumption, a trend exacerbated by the COVID-19 pandemic. De los Santos (2018) emphasizes that consumer search costs influence online behavior, as customers generally patronize only a limited number of well-known retailers, thereby conferring a competitive edge to established firms in the digital marketplace. Özekenci et al. (2019) utilize panel data from Turkey and European nations to demonstrate that GDP per capita, internet penetration, and inflation are substantial determinants of online purchasing at the macroeconomic level. These results corroborate the notion that economic conditions, technological advancement, and institutional quality collectively influence the proliferation of e-commerce among nations. Based on the literature we looked at, we suggest two hypotheses that can be tested:

H1: An increased proportion of internet users within the population correlates with a rise in the proportion of online purchases.

H2: A larger percentage of people aged 65 and older makes fewer online purchases.

We also think that income per person and regulatory quality will be positively related, while the consumption share in GDP will be negatively related because of budget limits.

Data Description

We use annual panel data for EU member states (EUROSTAT and TheGLobalEconomy) during 2020–2023. The dependent variable is the share of individuals making online purchases. The explanatory variables capture macroeconomic, institutional, technological, and demographic factors that the literature has identified as potential drivers of e-commerce adoption.

- GDP_pc (GDP per capita, current US dollars).

GDP per capita is included as a measure of economic wellbeing and purchasing power. Higher income levels are associated with greater capacity for households to access digital devices, internet services, and delivery options, which are prerequisites for online shopping. Moreover, wealthier countries tend to have better developed retail and logistics infrastructure that supports e-commerce expansion.

- Cons_share (Household consumption as % of GDP).

This variable indicates the extent to which an economy is driven by household consumption rather than investment or exports. A higher share may suggest strong consumer markets, but it does not automatically translate into more online shopping. In economies where consumption is concentrated in essential goods, a larger share of GDP devoted to consumption could actually mean slower adoption of online retail channels.

- Inflation (Annual CPI inflation, %).

Inflation reflects the general price environment faced by consumers. In theory, higher inflation reduces real purchasing power and may constrain spending. However, households facing rising prices may also switch to online channels if these provide lower costs or better opportunities to compare prices. Therefore, the effect of inflation on online shopping is ambiguous and worth testing empirically.

- Reg_quality (Regulatory quality index, World Governance Indicators).

This index captures perceptions of the government's ability to formulate and implement sound policies that promote private sector development. Strong regulatory quality supports digital trust, secure payment systems, and fair competition in online markets. In contrast, weak institutions may discourage consumers from adopting e-commerce due to concerns about fraud, lack of enforcement, or inadequate consumer protection.

- Internet_users (Internet users, % of population).

Internet penetration is a direct precondition for online shopping. Without access to the internet, households cannot engage in digital commerce. The higher the share of the population online, the broader the potential consumer base for e-commerce. This is the most fundamental technological driver of adoption.

- Broadband_subs (Broadband internet subscribers, in thousands).

Fixed broadband subscriptions refers to fixed subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s. This includes cable modem, DSL, fiber-to-the-home/building, other fixed (wired)-broadband subscriptions, satellite broadband and terrestrial fixed wireless broadband. This total is measured irrespective of the method of payment. It excludes subscriptions that have access to data communications (including the Internet) via mobile-cellular networks. It should include fixed WiMAX and any other fixed wireless technologies. It includes both residential subscriptions and subscriptions for organizations.

Fixed broadband matters for baseline access but is no longer the bottleneck for online shopping in much of Europe. People browse and buy on their phones, so 4G/5G coverage, typical mobile speeds and data prices describe retail connectivity better than household fixed-line counts. This likely explains why our fixed-broadband variable is not significant. Next steps should add mobile-network indicators or a simple "effective connectivity" index that blends fixed and mobile.

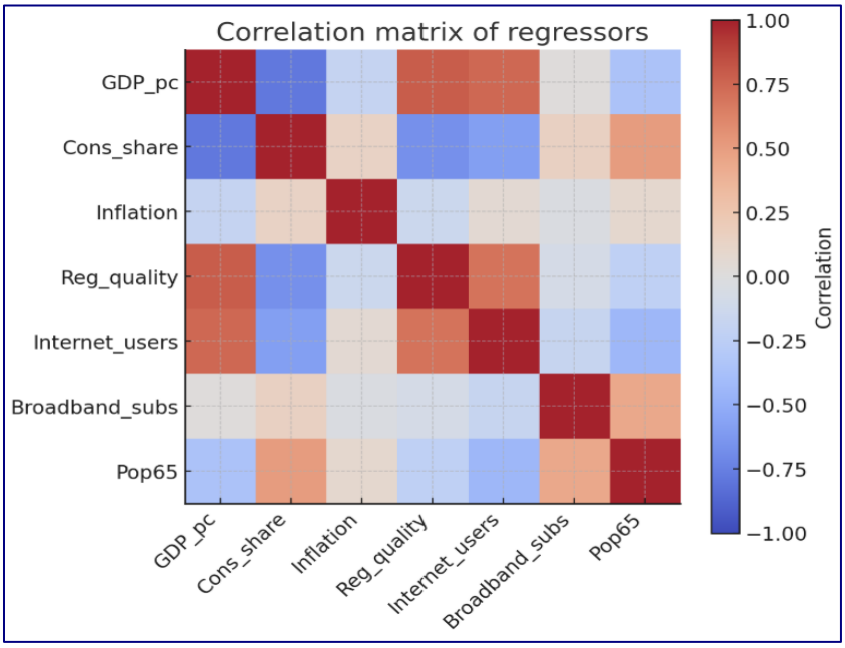
- Pop65 (Population aged 65+, % of total).

Demographic structure is also relevant for online shopping. Older populations are generally slower to adopt new technologies, which could reduce the overall share of online buyers. At the same time, the COVID-19 pandemic has shown that even senior citizens increasingly engage in digital commerce when circumstances demand it. The relationship between aging and online shopping is thus an open empirical question.

Since the regressors are conceptually related, we also examine the issue of multicollinearity. The correlation matrix (Figure 1) shows that some variables are strongly associated, for

instance income with both institutional quality and internet access. Others such as consumption share or ageing are moderately correlated with digital infrastructure. This indicates that the explanatory factors overlap to some extent, which requires careful interpretation of the coefficients. To address this, we consider them separately in the regressions and rely on robustness checks.

Figure 1. Multicollinearity checks



Source: own processing

Results

In Table 1 the estimation results are presented using random-effects GLS models where each explanatory variable enters separately. The choice of the random-effects specification is supported by the Hausman test which indicates that the more efficient random estimator is appropriate in this setting. In addition, all series are stationary in levels according to the Levin Lin Chu test, which ensures that the regressions are not affected by spurious correlations. The results therefore provide reliable evidence on the structural determinants of online purchases across European Union member states during 2020 to 2023.

The coefficients reported in Table 1 highlight the strong positive role of GDP per capita, regulatory quality and internet penetration in driving online purchases, consistent with previous studies that emphasize the importance of income, institutions and digital infrastructure for e-commerce development (Özekenci et al. 2019; Roszko Wójtowicz et al. 2024). The results also show that household consumption share is negatively associated with online shopping, suggesting that economies where consumption dominates GDP may rely more on traditional retail channels. Inflation has a small but significant positive effect, which may indicate that households under price pressure seek cheaper alternatives through online channels, a finding in line with evidence that shocks such as the energy crisis accelerated the turn to digital commerce.

Table 1. Random Effects results

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GDP_pc	0.2402 (0.0000)						
Cons_share		-0.0088 (0.0000)					
Inflation			0.0028 (0.0035)				
Reg_quality				0.1789 (0.0000)			
Internet_users					0.0101 (0.0000)		
Broadband_subs						0.0319 (0.1856)	
Pop65							0.0221 (0.0098)
Intercept	-1.9452 (0.0000)	1.0119 (0.0000)	0.5426 (0.0000)	0.3622 (0.0000)	-0.3395 (0.0110)	0.3066 (0.1110)	0.1130 (0.5180)
R-squared	0.5817	0.5048	0.0038	0.5998	0.5356	0.0080	0.0459
Observations	108	108	108	108	108	107	108

Source: own processing. Note: Because predictors are expressed in heterogeneous units, we emphasize signs and significance; economic magnitudes should be compared with caution.

The remaining variables reveal mixed evidence. Broadband subscriptions are not significant, which suggests that general access to the internet is more critical than the intensity of fixed connections, in line with results from Lola and Bakeev (2023) who found that smartphone penetration matters more than technical infrastructure in explaining e-commerce adoption. This non-significance is consistent with a **mobile-first** shift in European online shopping; fixed-line subscriptions are a weak proxy for effective retail connectivity.

The share of the population aged 65 and above shows a positive coefficient, contrary to the traditional expectation that ageing reduces digital uptake. This reflects the pandemic-driven acceleration of digital inclusion among seniors and supports the view of Roszko Wójtowicz et al. (2024) that demographic trends interact with innovation and shocks in shaping consumption. The positive link for the 65+ share likely reflects habits formed after the pandemic, telehealth, home delivery, simpler interfaces, rather than “digital nativity.”

Conclusions

The findings have important implications for consumers. Higher income levels, better regulatory quality and wider internet access are consistently associated with higher online shopping. This means that consumers in countries with strong institutions and robust digital infrastructure benefit from more convenient, secure and affordable digital markets. At the same time, the positive link between ageing and online purchases suggests that digital inclusion has improved among older citizens, which can reduce social inequalities in access to goods and services.

For policymakers and firms, the results highlight the importance of macroeconomic and institutional factors in shaping e-commerce. Fiscal and digital policies that enhance purchasing power and trust in online markets will directly support further expansion of digital commerce. For fiscal authorities this means that stabilizing inflation and supporting

household incomes indirectly fosters e-commerce adoption. For companies the evidence suggests that investment in accessible platforms and clear communication of trust and security is essential, since consumers respond strongly to improvements in regulatory quality and internet penetration. Overall, the study confirms that online shopping is not only a matter of technology but also of institutional design and consumer confidence, which makes it a strategic priority for governments and firms alike.

For firms, three priorities stand out: fast, mobile-first UX; visible trust signals (verified reviews, easy returns, clear data use); and local playbooks that match income, institutions and logistics in each country.

Limitation

A key measurement limitation is our reliance on fixed-broadband subscriptions; future work should integrate mobile-network metrics or a composite 'effective connectivity' index. Other limitations include heterogeneous units across predictors, potential omitted variables (e.g., card usage, urbanization), and possible endogeneity.

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THE ROLE OF FINANCIAL INCLUSION IN REDUCING SOCIAL VULNERABILITY IN THE REPUBLIC OF MOLDOVA

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Abstract:

The paper examines practical ways to strengthen the scientific and methodological foundation for reducing social vulnerability by expanding financial inclusion among low-income groups in the Republic of Moldova. A key element of the study is the introduction of the "financial inclusion threshold", understood as the minimum income level and economic autonomy required for meaningful participation in the formal financial system. The research aims to highlight the main difficulties faced by vulnerable groups in accessing and using financial services and to identify instruments tailored to their needs. The analysis combines statistical data on demographics and pensions with a comparative review of savings products designed for seniors, as well as social and digital inclusion programmes. Preliminary results show that elderly people, rural households, and informal workers encounter significant barriers such as insufficient income, limited financial literacy, and poor access to digital infrastructure. As a response, the paper proposes an Integrated Financial Package for Seniors, including preferential savings accounts, socially guaranteed microloans, multifunctional social cards, and tailored health insurance, all supported by continuous financial education programmes.

Keywords: *financial inclusion threshold, economic vulnerability, low-income groups, elderly people, Republic of Moldova*

JEL classification: *G53, I38, O16*

Introduction

The Republic of Moldova is undergoing profound economic and social transformations, driven by large-scale emigration, the shrinking of the active population, and accelerated population aging. Against this backdrop, older people represent one of the most vulnerable social groups, as they face income insufficiency, restricted access to quality public services,

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and significant challenges in adapting to digital transformation. In rural areas, where infrastructure remains underdeveloped and economic opportunities are scarce, the extent of social and financial exclusion is even more pronounced.

Financial inclusion is internationally recognized as an essential instrument for reducing inequalities and strengthening economic resilience. Access to bank accounts, savings products, microcredits, insurance, and digital services can enhance income stability and ensure a more dignified standard of living for vulnerable groups. At the same time, financial inclusion facilitates social integration by reducing dependence on informal mechanisms and increasing trust in financial and public institutions.

However, in the Republic of Moldova, financial inclusion policies have focused primarily on expanding formal access, namely the opening of bank accounts, the use of cards for pension payments, or the increase in credit volumes, without addressing in depth the structural barriers that hinder the transformation of access into effective participation. Low income levels, the lack of financial and digital literacy, as well as a deficit of trust in institutions, leave a large share of the elderly population de facto financially excluded.

The specialized literature occasionally addresses the threshold effects of financial inclusion, highlighting that the positive impact on poverty and inequality occurs only when certain critical levels are reached. Nevertheless, these analyses are fragmented and fail to capture the complex dimensions of actual participation. In this regard, the present study introduces the concept of the "financial inclusion threshold," defined as the set of minimum conditions (adequate income, accessible infrastructure, financial and digital skills, and trust in institutions) that make the effective use of financial services possible.

The contribution of this research is twofold. On the one hand, it provides a conceptual and methodological framework for defining and operationalizing the financial inclusion threshold. On the other hand, it examines the current situation in the Republic of Moldova, with a focus on the vulnerability of older people, and identifies practical tools for its reduction. The article proposes an Integrated Financial Package for Seniors, which encompasses social deposits with additional benefits, emergency microloans, multifunctional social cards, and financial education programs, complemented by international experiences and good practices such as social banking, age-friendly banking, postal banking, and social vouchers.

The structure of the article is as follows: a review of the specialized literature on financial inclusion and its relationship with social vulnerability; a description of the methodology and data used, including the proposal for operationalizing the financial inclusion threshold; a discussion of the results, with a focus on the situation in the Republic of Moldova and relevant international examples; and a synthesis of the main conclusions and public policy recommendations.

Literature Review

Over the past two decades, financial inclusion has become a central concept in the economic and social literature, being closely linked to the objectives of sustainable development and the reduction of inequalities.

According to the World Bank's Global Findex Database, global access to formal financial accounts has increased significantly, from 51% in 2011 to 76% in 2021, indicating substantial progress in expanding universal access to financial services (World Bank, 2021). Nevertheless, the report shows that disparities between regions and social groups remain

significant, particularly for women, older people, and rural households, where the main barriers are insufficient income, high costs, and the lack of digital infrastructure.

Most international studies measure financial inclusion through quantitative indicators, such as the number of bank accounts, the rate of card usage, or the volume of credit granted. While these indicators allow for cross-country comparisons, they capture reality only partially, without reflecting the structural and social barriers that prevent the transformation of formal access into effective participation. The report Measuring Financial Inclusion: The Global Findex Database, published by the FDIC, highlights this methodological limitation, showing that statistical data do not capture dimensions such as disposable income, local infrastructure, or the level of financial literacy (FDIC).

A particularly relevant aspect for the subject of this research is the financial inclusion of older people, a category highly exposed to risks of economic and digital exclusion. In the United States, the Money Smart for Older Adults program, developed by the FDIC and the Consumer Financial Protection Bureau, provides seniors with financial education, support for fraud prevention, and practical tools for managing income in retirement (FDIC; CFPB, 2025). Although such initiatives contribute to enhancing individual resilience, they remain focused more on education and protection and less on integration within a systemic framework of financial inclusion.

Another important element emphasized in the specialized literature is financial and digital literacy. According to the Toolkit for Measuring Financial Literacy and Financial Inclusion developed by OECD/INFE, the lack of financial skills represents a major barrier to the use of banking services, even when formal access exists. Thus, individuals with low levels of financial and digital literacy remain trapped in a cycle of economic vulnerability, which increases the risk of social exclusion (OECD, 2018). This issue is particularly acute in the case of older people, where the digital divide overlaps with the economic one.

The literature also provides examples of international good practices, demonstrating that the success of financial inclusion depends on the integration of economic, educational, and institutional dimensions. The social banking models in Central Europe (Erste Group), age-friendly banking services in Spain, the expansion of financial access through postal banking networks in France and Italy, and the use of social vouchers in the European Union illustrate that effective financial inclusion requires solutions adapted to the local context and to vulnerable groups.

The literature review, however, highlights several important gaps. First, there is no integrated conceptual framework that explicitly defines the minimum conditions for effective participation in the financial system. Second, the excessive emphasis on quantitative indicators limits the understanding of the complexity of the phenomenon and of the real barriers faced by vulnerable groups. Third, in the case of the Republic of Moldova, existing research has focused mainly on pension levels and poverty indicators, without directly examining the link between financial inclusion and the social vulnerability of older people.

These findings justify the need for a new approach, in which the concept of the “financial inclusion threshold” can help fill the theoretical and practical gap in the specialized literature. At the same time, the analysis of the Moldovan context, correlated with international good practices, provides a valuable framework for formulating tailored public policies, oriented not only towards expanding formal access but also towards strengthening real and sustainable participation in financial life.

Methodology and Data

The study is based on a mixed exploratory-analytical approach, which combines the quantitative analysis of statistical data with the qualitative assessment of existing products and programs in the field of financial inclusion. The choice of this strategy is determined by the complex nature of the subject, which involves both the measurement of objective dimensions, such as income levels and the use of banking services, and the analysis of qualitative aspects, such as trust in institutions or the barriers perceived by users.

For the quantitative component, official data provided by the National Bureau of Statistics (NBS) and the National Social Insurance House (NOSI) were used. The selected indicators include the minimum subsistence level, the average pension, the relative poverty rate, the coverage of financial services, and access to digital infrastructure. These data were complemented by the World Bank's Global Findex Database, which provides internationally comparable information on financial inclusion.

For the qualitative component, financial products and services targeting older people and other vulnerable groups were analyzed. Essential sources included the documentation of banking institutions (EXIMBANK, Victoriabank, Moldindconbank, maib), the offers of savings and loan associations, as well as the reports of non-governmental and international organizations (HelpAge Moldova, AO Casmed, UNFPA, UNDP, OECD). In parallel, international good practices in social banking, age-friendly banking, postal banking, and social voucher systems were examined, with the aim of identifying elements that can be adapted to the Moldovan context.

An important contribution of this research lies in the proposal and operationalization of the concept of the "financial inclusion threshold," understood as a composite indicator that brings together four fundamental dimensions: disposable income above the minimum subsistence level, access to financial and digital infrastructure, basic financial and digital literacy, and a sufficient degree of trust in formal institutions. The application of this framework shows that, as of July 1, 2025, the average pension (4,411.3 MDL) was approximately 72% higher than the minimum subsistence level (2,568.4 MDL). This evolution indicates an improvement in the statistical ratio between income and basic living costs; however, it does not automatically guarantee overcoming the real barriers to financial inclusion, which are related to the unequal distribution of income, deficient rural infrastructure, and the low level of financial and digital literacy.

The analysis focused primarily on older people (65+), considered the group most exposed to the risk of financial exclusion, but it also included references to rural households and informal workers. This delimitation of the analyzed population makes it possible to capture the specific characteristics of vulnerable groups without generalizing the conclusions to the entire population.

The methods employed involved comparisons between national and international indicators, the interpretation of discrepancies and convergences, as well as the qualitative evaluation of existing products and programs. By correlating these dimensions, the research goes beyond a purely statistical description of the situation and seeks to provide an analytical framework applicable to the formulation of public policies aimed at reducing social vulnerability through the expansion and strengthening of financial inclusion.

Defining and Operationalizing the Financial Inclusion Threshold

A distinctive element of this research is the proposal to introduce the concept of the "financial inclusion threshold," which, although touched upon tangentially in some studies addressing threshold effects of inclusion on poverty, inequality, or economic growth, has not been explicitly and systematically formulated in the specialized literature. In most cases, the level of financial inclusion is measured through quantitative indicators, such as the number of bank accounts, the volume of deposits, or the frequency of credit service usage. While useful, these data fail to fully capture the structural and functional barriers that condition the actual participation of vulnerable people in economic life. In this context, the notion of the financial inclusion threshold brings added value by providing an interpretive framework for identifying the minimum conditions required for meaningful access to the formal financial system.

The financial inclusion threshold can be understood as a set of basic resources and conditions that enable sustainable participation in financial life. Beyond simple statistics on access to accounts or cards, this concept reflects the idea that effective use of financial products requires not only the supply provided by institutions but also the user's ability to transform access into a real benefit. This presupposes the existence of a stable income exceeding the minimum subsistence level, the availability of physical and digital infrastructure, a basic level of financial and digital literacy, and a sufficient degree of trust in institutions. The absence of any of these conditions significantly limits the likelihood that financial inclusion will contribute to reducing social vulnerability.

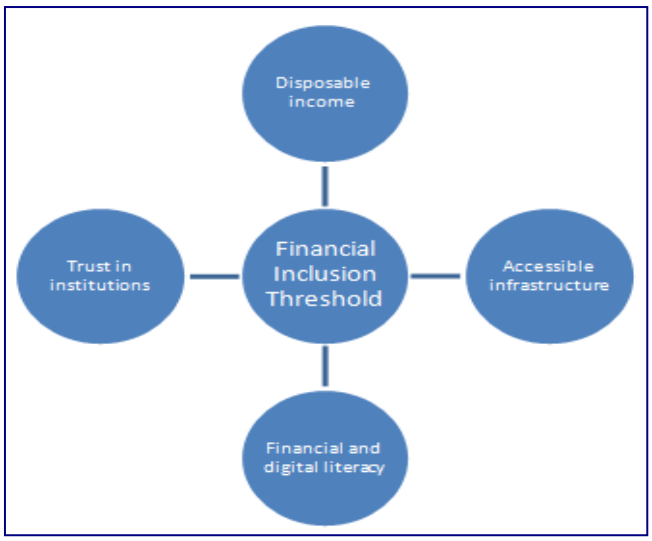
From an applied perspective, the threshold can be conceived as a composite indicator that brings together these dimensions into a measurable and comparable formula. In the Republic of Moldova, the discrepancies between the average pension and the minimum subsistence level clearly demonstrate the relevance of this approach: even though official incomes have improved, a considerable share of older people remains below the level required for effective integration into the formal financial system. Moreover, the low level of financial literacy and the lack of digital infrastructure in rural areas reinforce vulnerability and perpetuate exclusion.

Under these conditions, the financial inclusion threshold becomes a particularly useful analytical tool for identifying high-risk groups and for designing better-targeted public policies. It makes it possible to distinguish between formal access, often symbolic, and real participation, which entails the responsible and consistent use of financial services.

From this perspective, surpassing the threshold is not merely a matter of income but the outcome of a combination of economic, social, and institutional factors, whose interaction determines the extent to which financial inclusion can contribute to reducing social vulnerability and strengthening economic cohesion.

Figure 1 conceptualizes the financial inclusion threshold as an integrated construct, structured around four key dimensions (income, infrastructure, literacy, and trust) that together determine the effective participation of vulnerable groups in the financial system.

Figure 1: The Dimensions of the Financial Inclusion Threshold



Source: Elaborated by authors

This conceptual framework provided the foundation for the empirical analysis presented below.

Results

The analysis of statistical data confirms the existence of a significant discrepancy between the actual incomes of older people and the minimum subsistence threshold. As of July 1, 2025, the average pension amounted to 4,411.3 MDL, exceeding the minimum subsistence level (2,568.4 MDL) by approximately 72%. This difference suggests that, although pensioners' resources appear to be above the subsistence threshold, they do not automatically guarantee effective integration into the formal financial system, since barriers such as low financial literacy and limited access to digital infrastructure continue to constrain real participation.

To illustrate more clearly the discrepancy between the actual incomes of older people and the minimum subsistence threshold, Table 1 presents a comparative overview of the average pension and the minimum subsistence level in the Republic of Moldova for the year 2024.

Table 1: The Ratio between the Average Pension and the Minimum Subsistence Level in the Republic of Moldova, 2024

Indicator	Value (MDL)	Ratio to the Minimum Subsistence Level
Minimum Subsistence Level	2,568.4*	100%
Average Amount of the Established Monthly Pension	4,411.3**	172%

*Source: National Bureau of Statistics (NBS).Footnote: * First Semester 2025; ** July 1, 2025*

The present analysis highlights that older people in the Republic of Moldova continue to represent a socially vulnerable group, facing limited income, reduced access to modern financial products, and difficulties in adapting to the digitalization of public and banking services. Although the average pension exceeded the minimum subsistence level in 2025, this increase does not fully compensate for the real cost of living, and in practical terms, many pensioners continue to experience financial and social constraints.

The results reveal notable differences between urban and rural areas. In rural regions, access to financial and digital infrastructure is significantly more limited, which restricts the use of bank cards and online services. Moreover, the low level of financial and digital literacy, particularly among older people, reduces the chances of effective financial integration. Thus, mere formal access to an account or card does not translate into real and sustainable participation.

The evaluation of banking products designed for pensioners shows that current offers (such as “Depozitul SENIOR” (EXIMBANK), “Alături VB” (Victoriabank), and “Pensionar cu prelungire” (Moldindconbank)) provide some specific benefits but fail to adequately address the complex needs of this social category. In this context, an integrated approach tailored to the needs of older people is essential, one that combines social assistance with accessible, flexible financial instruments accompanied by financial education. Existing initiatives developed by banking institutions (maib, EXIMBANK, Victoriabank, Moldindconbank), non-governmental organizations (HelpAge Moldova, AO Casmed), public authorities (CNAS, Ministry of Labour), and international partners (UNFPA, UNDP, Swiss Agency for Development and Cooperation) represent a solid starting point.

The analysis of banking products designed for pensioners reveals significant differences in terms of interest rates, accessibility, and flexibility. These particularities are synthesized in Table 2, which provides a comparative overview of the main savings offers for seniors available on the market in the Republic of Moldova.

Table 2: Comparative Analysis of Savings Products for Seniors in the Republic of Moldova

Institution	Product Name	Interest Rate (MDL, annual)	Minimum Amount	Flexibility (Deposits/ Withdrawals)	Accessibility	Special Benefits
Victoriabank	“Alături VB” Deposit	Up to 5.25% (fixed)	5,000 MDL	No partial deposits/ withdrawals allowed	Online / Counter	Higher interest rate for online opening
EXIMBANK	SENIOR Deposit	5.00% (floating)	1,000 MDL	Deposits allowed in the first 3 years; no partial withdrawals	Counter	Free bank card; +0.25% interest for social card
Moldindconbank	Pensioner Deposit with Extension	Up to 3.00% (fixed)	1,000 MDL	Deposits allowed; partial withdrawals permitted (up to 30% of balance/ month)	Counter	High flexibility for withdrawals
AEÎ MicroÎmprumut	Pensioner Deposit	7.00% (fixed)	300 MDL	Additional deposits allowed; no early withdrawals	Counter	Competitive interest rate; no fees; gift at maturity

Source: Compiled by the authors based on data from the official offers of commercial banks

Beyond the domestic context, it is equally important to explore international approaches that address similar challenges.

A central outcome of the research is the formulation of the concept of an Integrated Financial Package for Seniors, designed to reduce social vulnerability by combining multiple instruments. This package would include savings accounts with preferential interest rates and social incentives, state-guaranteed microcredits for unforeseen expenses, multifunctional social cards integrating payment functions and social benefits, health insurance tailored to older people, and continuous programs of financial and digital education.

Nevertheless, there are valuable initiatives implemented by the banking sector, non-governmental organizations, and public institutions that demonstrate the potential of integrated solutions: bank deposits with social benefits, financial education programs, accessible microloans, multifunctional social cards, and intergenerational digital inclusion activities. In order to transform these initiatives into policies with systemic impact, a coherent vision is needed, one oriented towards the development of inclusive financial instruments tailored to the specific needs of older people. Such an approach must be supported by an active partnership between the state, financial institutions, and civil society, as well as by legislative reforms that guarantee the safety, transparency, and accessibility of these instruments. The adoption of an Integrated Financial Package for Seniors, including components of saving, crediting, social protection, and financial education, can represent a strategic solution for reducing social vulnerability and for promoting dignity and financial autonomy in old age.

Comparison with international good practices confirms the relevance of such solutions. The social banking models developed by Erste Group in Central Europe have demonstrated their effectiveness in supporting vulnerable groups. In Spain, the concept of age-friendly banking has generated financial products tailored to seniors and infrastructures adapted to their needs. In France and Italy, the use of postal networks to expand financial access in rural areas has reduced regional disparities. In the United States, the Money Smart for Older Adults program of the FDIC/CFPB provides a combination of education, protection, and financial integration for seniors.

The comparative analysis of the Moldovan context and international good practices reveals significant opportunities for adapting and implementing successful models. To translate these lessons into concrete solutions, a strategic approach is required, one that combines private sector innovation with a regulatory framework and state support.

To complement the analysis of the national situation, the research also considered relevant experiences from other countries. Table 3 presents a synthesis of international good practices and their potential for adaptation to the Moldovan context, with emphasis on key principles, target groups, and relevance for local policies.

The comparative evidence synthesized in Table 3 illustrates the diversity of international approaches that combine financial, social, and educational dimensions to foster inclusion. These models demonstrate that financial inclusion cannot be reduced to a single policy instrument but requires a systemic framework.

The interpretation of these results highlights two major trends. First, the social vulnerability of older people in the Republic of Moldova is closely linked to income insufficiency and the lack of adapted infrastructure, which confirms the hypothesis that formal access alone is not sufficient for real participation.

Second, the existing initiatives, although valuable, are fragmented and do not yet constitute an integrated system. These findings support the need to introduce the concept of the financial inclusion threshold and to develop coherent public policies that go beyond the mere expansion of access and focus instead on effective and sustainable participation.

Table 3: Synthesis of International Good Practices and Their Potential Applicability for the Republic of Moldova

Good Practice	Key Principles	Main Target Group	International Examples	Relevance and Potential for Adaptation in Moldova
Social Banking	Commercial sustainability, "cash-plus" approach, partnerships with NGOs	Low-income population, micro-entrepreneurs, excluded groups	Erste Group (Austria, Slovakia, Romania) (Government Accountability Office)	High. Can be adapted by creating fiscal/regulatory incentives for banks to develop social banking divisions in partnership with local NGOs, supporting subsistence farming and small rural businesses.
Postal Banking	Use of existing infrastructure, universal coverage, low costs, trust	Rural population, older people, unbanked individuals	La Banque Postale (France), Poste Italiane (Italy), Banco Postal (Brazil) (AMEF Consulting)	Very high. The state-owned "Poșta Moldovei" has an extensive network and enjoys public trust. It can become a financial inclusion agent by offering basic services on behalf of commercial banks and the state.
Reverse Mortgage (HECM)	Monetization of housing assets, state guarantees, mandatory counseling	Older homeowners with low liquid income	HECM Program (USA) (Department of Housing and Urban Development)	Medium to high. Requires a robust legal framework and a guarantee mechanism. Could be piloted through a public–private partnership, with independent counseling playing a central role in building trust.
Social Vouchers	Targeted support, flexibility, dignity for beneficiaries, rapid digital implementation	Vulnerable households, pensioners, families with children	France, UK, Italy (during the pandemic) (ESSC)	High. Can be rapidly implemented for existing aid (e.g., energy compensation) through a social card. Provides a more efficient and dignified alternative to in-kind aid or complex compensations.
National Financial Education Campaign	Standardized curriculum, age-specific adaptation, delivery through community partners	All population groups, with focus on youth and older people	Money Smart for Older Adults Program (USA) (Federal Deposit Insurance Corporation)	Very high. Directly addresses needs identified in the USAID survey. The model is replicable and could be implemented by the National Bank of Moldova in partnership with line ministries and civil society.

Source: Compiled by the authors

Conclusions

The study has shown that the social vulnerability of older people in the Republic of Moldova is not explained solely by the level of pensions but by a combination of economic, institutional, and educational factors. Even though incomes have improved in recent years, disparities between urban and rural areas, low levels of financial and digital literacy, limited access to adapted banking products, and a lack of trust in institutions continue to restrict real participation in financial life. Therefore, the risk of social exclusion persists, confirming the need for public policies and integrated instruments aimed not only at ensuring formal access but also at strengthening the effective capacity to use financial services.

A central contribution of the research is the introduction of the concept of the financial inclusion threshold, which allows for a differentiation between formal access (accounts, cards) and real participation (sustainable use, tangible benefits). This analytical framework proves useful for identifying high-risk groups and for guiding public policies.

The results show that the mere expansion of banking infrastructure or the digitalization of services is not sufficient. Complementary measures are needed, such as savings incentives, tailored credit products, integrated social protection, and continuous financial education. The Integrated Financial Package for Seniors proposed in the article provides an example of a systemic solution that combines financial and social products with educational programs and legislative protection.

Comparison with international good practices confirms the relevance of such approaches. The social banking models in Central Europe, age-friendly banking services in Spain, postal banking networks in France and Italy, and financial education programs dedicated to seniors in the United States demonstrate that success depends on the integration of economic, educational, and institutional dimensions.

The practical implications of the research highlight the need for a coordinated approach that mobilizes public authorities, private actors, and civil society. For the National Bank of Moldova and other regulatory institutions, a priority direction is the development of a legislative and regulatory framework that would encourage commercial banks to design financial products and services tailored to seniors and vulnerable groups.

At the same time, the National Social Insurance House and the Ministry of Labour should integrate social payments through multifunctional cards that include additional benefits and easy access to digital public services, thereby reducing the barriers faced by older people. Financial institutions, in turn, have the responsibility to develop innovative products (such as state-guaranteed microcredits, savings deposits with social interest rates, and health insurance adapted to seniors) that better respond to the real needs of beneficiaries. In parallel, civil society and international partners can contribute to strengthening financial resilience through extended programs of financial and digital education, with particular attention to rural areas where disparities are more pronounced.

The limitations of the study are related to the limited availability of data on the actual use of financial services by seniors and to the absence of official indicators for measuring financial inclusion in relation to the minimum subsistence threshold. In addition, longitudinal evaluations of the impact of pilot programs implemented in the Republic of Moldova are lacking.

Future research directions include the full operationalization of the financial inclusion threshold through a composite indicator, the analysis of gender and territorial differences in

financial access, as well as the comparative evaluation of intervention models tested at the international level. These efforts can contribute to strengthening a methodological and policy framework aimed at reducing social vulnerability and promoting inclusive and sustainable development.

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ENHANCING ECONOMIC RESILIENCE THROUGH SECURE FINTECH PAYMENTS: A LEGAL AND REGULATORY ANALYSIS UNDER THE EVOLVING EU FRAMEWORK

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Abstract:

Digital payments are increasingly central to the European Union's financial ecosystem, but it seems that they face growing security and operational risks. This study is proposing to explore how secure fintech payment services can enhance economic resilience by ensuring business continuity, security of the payment servicesand so reducing systemic vulnerabilities. Methodology is by focusing on the EU regulatory framework, particularly Payment Services Directive PSD2 [1] and the forthcoming Third Payment Services Directive (PSD3) [2]/Payment Services Regulation (PSR) [3], to identify and emphasize adequate security measures to mitigate the risks associated to payment services. This might eventually lead to compliance from fintech entities to preserve the economic resilience. The preliminary result of the analysis shows that secure fintech payment services, when aligned with EU regulatory requirements, significantly strengthen economic resilience.The research proposes to emphasizehow the regulatory foresight combined with proactive security measures might foster a reliable, trusted, and resilient digital payment infrastructure, capable of supporting the EU economy under normal conditions and during periods of stress or disruption.

Keywords: *fintech payments, economic resilience, EU regulatory framework, PSD2/ PSD3/PSR compliance, digital payment security*

JEL classification: *G20, G28, O33*

Introduction

The European Union's (EU) financial ecosystemit seems that is undergoing a transformative shift driven by digitalization, innovation, and the most important the regulatory reform. This might be because digital payments, facilitated by fintech payment services providers of technical services providers that are supporting the payment services, are now an integral part of economic activity. However, their increasing reliance on technology introduces vulnerabilities that might threaten their security and consumer trust. This paper explores how secure payment services provided or supported by fintech entities, when aligned with the

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specific EU legal frameworks, might enhance economic resilience by mitigating systemic risks, ensure financial integration and consumers trust as an overall secure and resilient payment market.

As the EU has witnessed a profound transformation in financial services through the rapid digitalization of payment services, Fintech solutions, particularly in digital payments, have become indispensable to consumers, businesses, and other parties involved into the payments market. Their expansion, however, inevitably has also introduced systemic vulnerabilities, ranging from cyber threats and fraud to operational disruptions. Against this backdrop, it seems that secure digital payment infrastructures are not only a matter of technological advancement but tend to transform into a fundamental driver of economic resilience, understood as the capacity of financial systems to withstand, adapt to, and recover from disruptions.

So, in this perspective, the swift might be seen into an EU coordinated answer that has responded by establishing a comprehensive regulatory framework, most notably the revised PSD2 and the anticipated PSD3/PSR legal framework. These frameworks impose strict requirements for security, consumer protection, and operational reliability, while encouraging innovation or at least are ensuring the adequate perspective in this respect. This article examines how regulatory alignment and secure fintech innovations contribute to economic resilience across the EU, situating payment security as both a regulatory objective and a systemic necessity. Yet, the EU's strong emphasis on regulatory compliance contrasts with lighter, innovation-driven frameworks in jurisdictions such as the United States and Singapore, raising questions about costs for fintech competitiveness and additional burdens for innovation.

The objective of this study is to evaluate the role of secure fintech payment services in enhancing economic resilience within the EU. The analysis focuses on the interplay between technological innovation, regulatory compliance, and consumer protection. Specifically, it investigates how alignment with PSD2 provisions and the forthcoming PSD3/PSR framework contributes to trust, operational resilience, and security into the digital payments sector.

By centring on digital payments, arguably the most sensitive component of fintech services to cyberattacks, fraud, and technological disruptions the study is tying to bring some clarity into how regulatory foresight can strengthen resilience while also ensuring the adequate path for ongoing innovation in financial services, although this is a dilemma sometimes difficult to address.

The analysis also highlights regulation as a potential source of burden for fintechs, with possible consequences for innovation and competitiveness.

Despite growing academic and policy interest in fintech, existing literature remains fragmented in two ways. First, much of the scholarship emphasizes either technological innovation or financial stability, with limited integration of how regulatory compliance, security practices, and resilience mechanisms jointly shape the digital payments ecosystem. It seems that the regulators should have a more dedicated approach to innovation and so to establish a more flexible and adaptive regulatory framework to balance innovation and stability (Arner, Barberis & Buckley, 2017 [4]). Also it seems that the "full potential of FinTech to support a sustainable development may be realized with a progressive approach to the development of underlying infrastructure"that is supporting digital transformation of financial services(Zetzsche et al., 2020 [5]). Second, comparative studies often focus on global regulatory competition — contrasting EU, U.S., and Asian approaches — but rarely provide payment services–specific insights into how these regulatory choices influence resilience, trust, and innovation simultaneously. In my opinion, this gap might be particularly relevant as

the EU seeks to position itself as a leader in secure, consumer-centric financial services; while competing jurisdictions such as Singapore and the United States it might clearly adopt more innovation-oriented regulatory strategies. What clearly is characteristic to the evolution of FinTech is that the risks should also be considered not only the opportunities associated with extensive digitalization (Arner, Barberis & Buckley, 2017).

Therefore, although preliminary, the focus of the paper is to address these gaps by examining how secure fintech payment systems contribute to economic resilience within the EU regulatory framework and if the result might be verified in practice by the real functioning of the payment market. Specifically, it proposes to investigate how aligning payment innovations with PSD2, PSD3/PSR, and Digital Operational Resilience Act [6] (DORA) can strengthen trust, operational stability, and consumer protection, while also acknowledging potential regulatory burdens for fintech companies. By situating the analysis within the payment services domain, the study might contribute to understanding how regulatory foresight and compliance obligations can act both as enablers of systemic resilience and as constraints on innovation.

The contribution of this research is from the two perspectives. First, it offers a conceptual and regulatory-based evaluation of the resilience-building potential of EU payment regulation. Second, it includes some examples of how unclear regulatory framework or insufficient applied by the fintech entities this can impact the economic resilience. From this perspective, the article introduces two case studies (e.g., Klarna) that might illustrate how regulatory provisions could prevent or mitigate payment-related security and operational disruptions. It also situates the EU model within an international comparative perspective, highlighting both strengths and challenges in contrast with U.S. and Singaporean approaches.

The remainder of this article is structured as follows. Section 2 presents the literature review, section 3methodology and data, detailing the conceptual and regulatory approach and the rationale for case study selection. Section 4 provides the results and analysis, emphasizing the role of EU regulation in shaping trust, resilience, and innovation within digital payment services. Section 4 also discusses case studies with explicit mapping of incidents to PSD2/PSD3/DORA provisions. Finally, Section 5 reflects on conclusions and the limitations of the study and outlines future research directions. It also concludes with policy and industry implications for building a secure and resilient digital payments ecosystem in the EU.

Literature Review

At a glance, it seems that the literature highlights the dual role of regulation in financial innovation: as both an enabler of trust and a potential barrier to market entry (Zetzsche et al., 2020). Studies on PSD2 emphasize its impact on open banking, strong customer authentication (SCA), and secure communication protocols, all of which reduce fraud and improve consumer trust (European Banking Authority [EBA], 2019; Marangwanda, A., 2025 [7]). PSD2 also laid the groundwork for enhanced interoperability among payment service providers (PSPs), thereby reducing fragmentation across the EU financial market [8] (Roitman & Vives, 2021).

Emerging literature on PSD3 and PSR suggests a deeper harmonization of rules and increased supervisory convergence across Member States, aiming to reduce regulatory arbitrage and strengthen resilience (European Parliament, 2025 [9]; EY, 2023 [10]; Bird & Bird LLP, 2023 [11]). Parallelly, DORA introduces operational resilience requirements for ICT systems, explicitly targeting the digital backbone of financial services and mandating stress

testing, incident reporting, and third-party risk oversight (European Parliament & Council, 2022 [12]).

From the resilience perspective, secure digital payments act as buffers during crises, ensuring continuity of commerce and financial intermediation (Khioonarong, Leinonen, &Rizaldy, 2021 [13]). Yet, fintech firms often face higher compliance costs under EU law compared to lighter regimes elsewhere. Scholars argue that while stringent regulations foster resilience, they risk slowing innovation if not balanced with proportionality and support for smaller fintechs (Arner, Buckley, Zetzsche, & Veidt, 2019 [14]; Zetzsche, Arner, Buckley, & Kaiser-Yücel, 2020 [15]; IMF, 2020 [16]).

This review reveals a gap: while literature addresses fintech innovation and regulation separately, fewer works explicitly connect regulatory compliance in payment services to systemic resilience in the EU. This paper might contribute by integrating these dimensions.

Methodology and Data

This study adopts a conceptual and regulatory-based approach, analysing EU-level legislation, regulatory guidance, and institutional reports complemented by qualitative case study analysis to examine the potential role of secure fintech payment services in enhancing economic resilience within the European Union (EU). Rather than employing quantitative analysis, the research synthesizes EU directives, EBA guidance, and innovation monitoring practices. This approach allows for a nuanced assessment of the strengths and challenges of EU regulation in fostering resilient digital payments.

Research Design

The primary research design is conceptual and normative, focusing on the alignment of payment service innovations with EU regulatory frameworks. The analysis draws on EU directives and regulations, specifically the PSD2, the proposed PSD3/PSR, and the DORA. These frameworks establish legal and operational obligations for fintechs, including strong customer authentication (SCA), secure communication protocols, incident reporting, and ICT risk management.

To contextualize the conceptual findings, the study incorporates a case study approach that investigates real-world fintech security challenges and their regulatory implications. Case studies areparticularly suitable when the research seeks to answer “how,” “why,” or “what” questions (Yin, 2018 [17]). They allow for in-depth exploration of a security incident or payment services phenomenon that reveals systemic vulnerabilities and demonstrates the potential mitigating effects of regulatory provisions.

Case Study Selection

The first relevant case was the Klarna security incident of 2021 (Klarna, 2021, June 4) [18], that was chosen as the principal case study because it provides a concrete, high-visibility example of a payment services security failure within a major EU-based fintech. In May 2021, a technical glitch in Klarna’s systems exposed sensitive customer account details, allowing users to inadvertently access other customers’ information. This event raised critical questions regarding operational resilience, consumer data protection, and incident response mechanisms (Finansinspektionen. 2021, July 5) [19].

The Klarna case was selected for the following main reasons:relevance to payment services security and also for exploratory depth.

In this respect the relevance to payment services securityis considered because: Klarna operates at the core of EU digital payments, offering “buy-now-pay-later” (BNPL) services widely integrated into e-commerce (Stripe, 2024, January 19) [20]. The security of such services is directly tied to consumer trust and payment services business continuity. It is also to be considered its regulatory significance, so, in this context, the major incident reporting provides a lens to evaluate how PSD2/PSD3 and DORA provisions on data security and operational risk management could have mitigated or prevented the incident.

For the Exploratory Depth side, is to be considered that, by focusing on Klarna, the study can explore “how” security lapses occurred, “why” regulatory compliance gaps contributed to systemic vulnerabilities, and “what” lessons can be drawn for strengthening fintech resilience in the EU.

The second case is of the acquisition of Tink by Visa in March 2022, that marked a significant development in the European open banking landscape.

This case might be relevant from the payment services perspective as the Tink is a leading open banking platform, that offers a unified API that facilitates account information and payment initiation services across numerous banks [21]. This case of acquisition also underlines a Visa's strategic investment in standardized open-banking infrastructure. This might be an objective aiming to enhance alternative payment rails and expedite integrations for fintechs, merchants, and banks [22]. From this perspective the Tink case examines the possible implications of this acquisition from the perspective of PSD2, the forthcoming PSD3/PSR and DORA.

Data Sources

The case study draws from publicly available reports, press releases and regulatory documents that had analyzed the Klarna breach. Supplementary, this case was confronted with different applicable legislation and so, the references includes the legal perspective envisaged by the:PSD2 regulatory technical standards on strong customer authentication (RTS on SCA and CSC [23]), draft provisions from PSD3 and the PSR focusing on enhanced security and consumer protection, Articles of the DORA relevant to ICT incident classification and reporting.

Integration of Case Studies with Regulatory Mapping

The Klarna incident was examined through the lens of PSD2, PSD3, and DORA, toestablish the potential interplay on how regulatory requirements might translate into operational resilience for payment services. It seems that in this case, deficiencies in strong customer authentication and monitoring, as stipulated in PSD2 Article 97, enabled unauthorized access, while delays in reporting highlighted weaknesses under PSD2 Article 96 regarding notifications to competent authorities. It also can underline that insufficient ICT risk management and operational resilience planning in line with DORA Article 17, revealing gaps in testing and monitoring critical systems. Although even though nor DORA or PSD3/PSR were applicable at the time of the incident, it seems that anticipated enhancements under PSD3/PSR and currently applicable DORA (starting from 17 January 2025),particularly provisions harmonizing fraud/TIC incident reporting and data security, would further clarify

and standardize fintech obligations across EU jurisdictions. By systematically linking these regulatory provisions to a high-visibility incident, the analysis might demonstrate how regulatory alignment can enhance the security of digital payment services and strengthen economic resilience.

Regulatory Framework Analysis

PSD2/PSD3 and PSR: Strengthening Payment Services

The PSD3 Directive and PSR Regulation, proposed in 2023 and currently in trilogue negotiations, aim to modernize the EU's payment landscape. From this perspective the key provisions of PSD3/PSR legal framework include: i) unified licensing for payment and e-money institutions, ii) enhanced fraud prevention mechanisms, iii) clarified agent regimes for cross-border operations, iv) streamlined passporting procedures to reduce regulatory delays, v) capital requirement adjustments to balance innovation and risk.

These reforms reinforce trust and operational stability by ensuring that fintech providers meet consistent security and compliance standards across the EU.

DORA: Digital Operational Resilience

The DORA, effective since January 2025, introduces a uniform framework for managing ICT risks across financial entities. DORA mandates: i) ICT risk management frameworks, ii) incident reporting protocols, iii) third-party oversight for critical ICT providers, iv) threat-led penetration testing (TLPT), v) information sharing on cyber threats.

DORA complements PSD3/PSR by addressing the operational backbone of digital payments, ensuring that fintech systems can withstand and recover from cyberattacks and technological failures.

Results and Discussion

The integration of PSD2, and further PSD3/PSR and DORA, creates a robust regulatory ecosystem that enhances the security and resilience of digital payments. From this perspective it's foreseen that the main issues might be focused at the necessity to reduced fraud and cyber risk. This objective it seems that can be achieved through mandatory security protocols.It also,comprise an improved operational continuity via harmonized ICT resilience standards, greater consumer trust through transparency and accountability, cross-border scalability enabled by passporting regime; this is the case of a EU licence for a financial institution allowing to provide payment and ancillary servicesacross all other member state and so a unified licensing.Also, it includes the premisses for a regulatory foresight through innovation monitoring and adaptive compliance.

These elements might collectively strengthen the EU's financial infrastructure, ensuring that digital payments remain reliable during both normal operations and periods of disruption.

Case studies results for Tink and Klarna (Europe)

Tink (open banking)/Visa acquisition: enabling resilient payment rails through API standardization [24]

What happened: Tink, a leading European open-banking platform, provides a single API for account aggregation and payment initiation services across multiple banks. Visa completed its acquisition of Tink in March 2022, signalling strategic investment in standardized open-banking infrastructure that enables alternative payment rails and faster integrations for fintechs, merchants and banks. From this perspective the Charlotte Hogg, CEO of Visa Europe underlined that "*Digital tools are driving the new economy, and the combination of Visa and Tink will support greater choice and quality of digital money services as the lines between commerce, financial services and payments continue to converge*" (Tink, 2022). The risk that was identified is of the fragmentation of APIs and security standards across banks.

This case might be a clear relevance from the link of payments & resilience: Open-banking platforms such as Tink increase interoperability and reduce the integration friction that can make payment flows fragile. By enabling payment initiation and standardized data exchange, openbanking APIs distribute transactional paths and reduce single-point dependency on proprietary connectors. Standardization is a characteristic for the APIs that enables compliance with the procedure for strong costumer authentication (SCA) and secure communication more scalable across multiple PSPs (EBA, 2022) [25].

Relevant provisions of the legal framework: PSD2 Articles 66–67: Rights and obligations of Account Information Service Providers (AISPs) and Payment Initiation Service Providers (PISPs), mandating secure, standardized communication; RTS on SCA and CSC: Requires secure communication protocols and authentication for API calls; PSD3/PSR proposal (Art. 38): Expands harmonization of open-banking APIs, including minimum performance standards, dispute resolution for API failures, and dedicated fallback requirements.

From the resilience impact perspective: by enforcing standardized APIs and fallback mechanisms, PSD3 will further reduce systemic fragmentation risk, making platforms like Tink resilience enablers instead of potential points of friction.

Resilience lessons: Investing in shared API layers and resilient connectivity (redundant endpoints, standardized authentication flows) might improve continuity after partial outages and accelerates recovery. It is also open from prospection to what extent the standardized APIs can also facilitate compliance (easier rollout of SCA requirements based on the RTS on SCA and CSC) and so might lowering the operational burden on smaller fintechs.

Klarna (Europe), outages in payment methods and incident transparency

What happened: On 2 October 2021 Klarna experienced disturbances in its payment methods across Europe that disrupted payment authorizations and checkout flows for merchants and customers. Klarna published a detailed incident report describing the event and remediation steps (Klarna, 2021 [26]). As a risk finding, Klarna case was a major PSP disruption cascading to e-commerce flows and merchant settlements. [27]

Relevance to payments & resilience: Klarna is a major PSP and BNPL provider with significant payment volume. Disturbances in such large PSPs can ripple through e-commerce and merchant cash flows that might illustrate systemic impact even from “non-bank” fintechs. Klarna’s public post-incident reporting is a resilience best practice, fostering transparency and quicker remediation across ecosystems.

Relevant provisions: PSD2 Article 96: Obligation to report major security incidents to competent authorities without undue delay; PSD3/PSR proposal (Art. 46): Strengthens fraud reporting obligations and requires providers to share incident data with authorities for systemic risk assessment; DORA Articles 17–20: Major ICT incident reporting, classification, and supervisory information-sharing across EU.

Resilience impact: Klarna’s public transparency aligns with the future mandatory incident disclosure regime under DORA, showing how regulatory foresight formalizes best practices into binding rules.

Resilience lessons: Large fintech PSPs must combine real-time monitoring, major ICT incident reporting, and cross-stakeholder communication to limit economic fallout. Although the DORA requirements were not applicable at that time, DORA’s incident-reporting regime (and supervisory coordination) seeks to institutionalize such practices across the financial sector.

Table 1. Klarna Incidents: Operational Disruption vs Confidentiality Breach

Incident	Type of Disruption	Affected Payment Services / Users	Regulatory Implications for Resilience
Oct 2, 2021	Log-forwarder performance issue leading to checkout failures and service slowness for merchants & consumers	Card payments, checkout flows, app availability, payment account setup	Highlights need for redundancy, real-time monitoring, incident reporting (e.g. DORA & PSD2)
May 27, 2021	Cache misconfiguration exposing user data among app users	Exposure of personal & sensitive payments data, risk to confidentiality, regulatory risk, customer trust	Points to data protection (GDPR), secure coding/config practices, internal change governance under PSD2/PSR/DORA

Source [28]: Klarna (2021) https://www.klarna.com/international/press/detailed-incident-report-disturbances-to-klarnas-payment-methods-in-europe-on-october-2-2021

Trends and relationships identified from operational disruption and data exposure perspective.

Operational disruptions (service slowdowns, checkout failure) have direct economic impact: lost merchant sales, consumer dissatisfaction, reputational harm. Even though no external attack was noted, these disruptions reduce reliability in payment services, which can feed back into reduced trust and usage.

Data exposure (though temporary) threatens confidentiality and can trigger regulatory penalties or remedial measures. It shows that security isn't only external attacks but internal changes/configuration errors matter.

The regulatory mapping earlier is proposing to show that existing and upcoming rules (PSD2 SCA/secure communication, incident reporting, ICT risk governance under DORA) might be relevant for preventing or mitigating such incidents.

Regulatory mapping: explicit links between case studies and PSD2/ PSD3/PSR/DORA provisions

The analysis maps the practical vulnerabilities observed in the case study to specific legal provisions in (a) PSD2 and its RTS on SCA and CSC, (b) the PSD3 / PSR proposal, and (c) the DORA.

Table 2: Case studies: events, payment-service impacts, and resilience lessons

Case (year)	Type of event	Payment-service impact	Resilience lesson
Tink / Visa (2022)	Open-banking platform acquisition/scale	Improved API standardization & payment initiation (enables alternate rails)	Standardized APIs increase interoperability & scalable SCA implementation
Klarna outage (2021)	PSP service disruption	Merchant checkout failures; consumer payments delayed	Public incident reports reduce systemic spillovers

Source: Tink (2022) https://tink.com/press/visa-completes-acquisition-tink/, Klarna (2021) https://www.klarna.com/international/press/detailed-incident-report.

Combined Trends: Payments Security to Resilience

Combining the broader fraud trends and the Klarna case yields the following key relationships:

Regulation (PSD2 & other security standards) lower fraud in payment instruments, particularly those under strong authentication (card payments within EEA). The empirical fraud data shows this correlation clearly (fraud rates much lower in EEA-SCA context).

Operational integrity and incident preparedness, business continuity of payment services Klarna's practice of incident escalation, switching traffic, scaling services shows that internal processes matter. Regulatory requirements under DORA/PSR could standardize these processes across PSPs.

Consumer trust and liability allocation: Where incidents are transparent, and PSPs abide by rules (e.g. report incidents, protect data), user trust can be preserved, mitigating economic fallout.

Summary of Main Outcomes

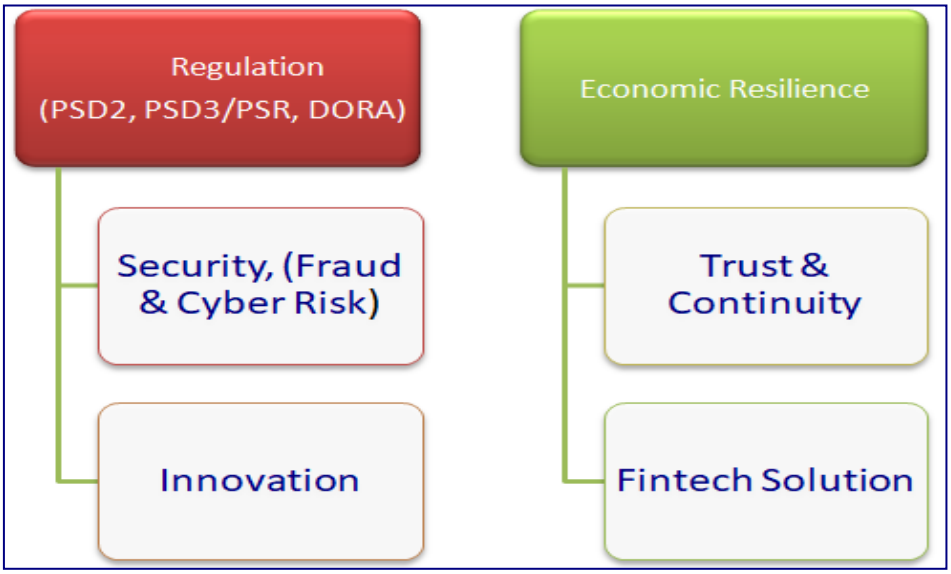
Empirical support for regulatory efficacy: PSD2-mandated SCA and accompanying RTS/CSC have measurable impact, since the fraud rates in card payments and e-money are significantly lower than for less regulated instruments [29].

Operational disruptions are not insignificant: events like the Klarna outage show how internal system metrics (log-forwarder, caching) can leadinto performance failures if change management, monitoring, redundancy, and alerting are not robust.

Regulatory gaps/emerging needs: even with PSD2, gaps remain in guaranteeing high availability; upcoming PSD3 and DORA provisions are likely to strengthen required resilience.

Trade-off in compliance cost vs benefit: increased regulatory requirements bring costs, especially for smaller fintechs, but case studies suggest that cost is justified by lowered fraud, improved reliability, and thereby enhanced economic resilience.

Figure 1 The Resilience in EU Digital Payments



Source: Author's elaboration, adapted from EU regulatory framework and resilience theory.

The results of this study highlight a central paradox in the European Union's regulatory framework for payment services: while the adoption of PSD2, the forthcoming PSD3/PSR, and the DORAsignificantly enhances trust, consumer protection, and systemic stability, these same instruments may impose operational and compliance burdens that can restrict innovation in fintech firms offering paymentorrelated technical services.

EU Regulation as a Driver of Trust and Stability

The empirical and case-based findings underscore that security and consumer confidence are primary outcomes of the EU regulatory architecture. PSD2's provisions on Strong Customer Authentication (SCA, Art. 97) and open banking requirements (Arts. 66–67), combined with DORA's Article 9–15 operational resilience obligations, have reinforced customer trust in digital payment platforms. Case evidence from Klarna's payment disruptions in 2021 indicates that the regulatory focus on incident reporting (DORA, Art. 17) could have mitigated the reputational and systemic impact. These results align with broader studies showing that regulationdriven trust enhances adoption of digital payment solutions across the EU (ECB, 2022 [30]; European Commission, 2023 [31]).

Regulation as a Potential Barrier to Innovation

At the same time, the study identifies a recurring theme: compliance costs and regulatory fragmentation create significant challenges for fintechs, especially smaller firms. Respondents in industry surveys (EBA, 2022 [32]) highlight that overlapping mandates (PSD2, GDPR, AMLD5, and now DORA) stretch technical and financial resources, reducing the capacity for rapid product iteration. For example, API providers and third-party payment initiators have reported delays in launching new features due to the rigidity of SCA standards, which limit the flexibility to design seamless user experiences (Anagnostopoulos I., 2018 [33]).

Comparative Insights: U.S. and Singapore

The EU's regulatory design contrasts with innovation-led frameworks in other jurisdictions:

In the United States, Regulation of fintechs in payments remains fragmented and often state-based (Buchak et al., 2018 [34]). While this creates regulatory uncertainty, it also leaves space for sandbox-driven innovation, where firms can rapidly pilot products without the same operational resilience obligations imposed in the EU. Trust is often built via market competition and private liability mechanisms rather than centralized regulatory enforcement.

On the other side Singapore, under the Payment Services Act (PSA, 2019), the Monetary Authority of Singapore [35] (MAS) emphasizes a risk-proportionate regulatory model, allowing smaller fintechs to operate under tiered licensing regimes with lighter compliance burdens. This has made Singapore a hub for digital payment innovation, while still embedding cyber resilience standards for systemically significant operators (Frost, Gambacorta & Shin, 2021 [36]).

In both cases, it seems that innovation pathways are more flexible, suggesting that while the EU model leads in trust-building and systemic protection, it risks slowing the pace of technological diffusion within the payment ecosystem.

Implications for Economic Resilience

The analysis drives into the perspective that although EU regulation strengthens resilience by minimizing systemic shocks in payment services, it seems that may unintentionally concentrate market power in larger, resource-rich fintechs and banks; those seems more capable to absorb compliance costs [37]. It seems that smaller firms risk being excluded from the market, reducing diversity of payment solutions and potentially undermining the long-term adaptability of the payment ecosystem.

Conclusions

It seems that Fintechs that develop secure payment services, in compliance with the EU specific legal requirements, are foundational to economic resilience in the EU. In those terms, by aligning technological innovation with comprehensive legal frameworks, i.e. PSD2 for payment services, DORA for operational resilience and EBA guidelines for technical compliance, it seems that at the EU level, that is a sure path for building a future-proof payment and financial ecosystem. Although the research underscores the importance of regulatory synergy in fostering trust, security and continuity in digital payments, it also triggers the necessity for balancing it with a policy that sustain and support the innovation in payments. Those might be, in my opinion, an essential blueprint for policymakers, fintech developers, and financial institutions.

Concluding synthesis & policy implications

It seems that layered regulation prove to be complementary: PSD2 (and RTS on SCA and CSC) secures payment-level authentication and communication; PSD3/PSR aims to harmonize operational aspects; DORA embeds ICT risk and third-party oversight across the broader financial ecosystem. Mapping above shows that real incidents map neatly to gaps these regulations address (fragmented APIs, third-party concentration, incident reporting, AML/compliance integration, systemic infrastructure testing).

Also, in my opinion, applying the proportionality principle remains essential: DORA and PSD2 and especially PSD3 might give supervisors robust powers but impose costs. For resilience that preserves fintech diversity, regulators should apply proportionality, e.g., scaled testing and tailored third-party obligations. This might be a key policy and supervision lesson to avoid unintended burden for innovation in payment services provision. The DORA text itself references proportionality and tailored approaches in several places (see Article 5 of DORA).

Operational and compliance controls must be integrated: The Klarnacase shows governance/compliance weaknesses can produce operational constraints. PSD3's increased emphasis on fraud prevention plus DORA governance obligations might encourage integration of compliance, AML, and ICT resilience into a single risk architecture.

This study is trying to demonstrate that secure fintech payment systems aligned with the EU regulatory framework might significantly contribute to economic resilience. PSD2 and PSD3 provide robust security standards, while DORA ensures operational continuity in the digital infrastructure underpinning payments. Together, these frameworks can reduce systemic vulnerabilities, safeguard consumers, and maintain trust across the EU financial ecosystem.

Nonetheless, the EU's stringent approach might present serious challenges for fintech scalability compared to other innovation-focused jurisdictions, as US and Singapore. In my opinion, policymakers must balance resilience with proportionality, ensuring that smaller firms can innovate without excessive regulatory burdens. This is a fintech voice that, in my opinion, must be heard by future policy makers and by the supervisors.So, future research should empirically assess the trade-offs between regulatory strictness and fintech competitiveness.

Ultimately, in my opinion, asecure and compliant fintech payments services provider can serve as pillars of resilience. This might be a safe solution for enabling the EU to sustain economic activity under both ordinary and disruptive conditions.

Regulatory measures, particularly SCA under PSD2, demonstrably reduced fraud rates in value and volume, especially for payment instruments like cards and e-money [38].DORA's framework for operational resilience ensures that payment service providers, including fintechs and ICT third parties, are obligated to maintain infrastructure capable of resisting ICT disruptions.The convergence of payment security regulation and operational resilience obligations for sure are the right legal instruments for enhancing trust, reducing risk exposures, and supporting continuity of payments. Those might be the essential elements of economic resilience, from the payments services impact.

Limitations and Directions for Future Research

A key limitation of this study lies in its conceptual and regulatory-based approach, which, while offering valuable insights into the interplay between security, regulation, and resilience, does not incorporate quantitative primary data from payment service providers or fintech

firms. As a result, the analysis remains at a normative and case-based level, focusing on regulatory mapping and documented incidents (e.g., Klarna) rather than empirical validation of operational resilience across the broader ecosystem. Similar approaches in the fintech literature have highlighted this challenge: studies by (Buckley et al.,2023 [39]) and (Arner et al., 2017 [40]) stress that regulatory analysis often lacks firm-level operational data, limiting the ability to measure real-world compliance costs, innovation outcomes, and resilience trade-offs.

Another limitation concerns the generalizability of findings. While PSD2, the upcoming PSD3/PSR, and DORA form the backbone of EU payment resilience, fintech companies operating globally often face divergent frameworks (e.g., lighter innovation-focused regulation in Singapore or the United States). This it seems that creates a regulatory asymmetry that was only marginally addressed here, though it remains crucial for assessing the global competitiveness of EU-based fintechs (Buchak et al., 2017 [41]; Frost, Gambacorta & Shin, 2019 [42]).

Future research should pursue empirical and comparative studies with direct input from fintech providers. *Surveys and interviews* with payment processors, API providers, and third-party service platforms could provide detailed insights into:i) Operational costs of compliance with PSD2/PSD3 and DORA requirements, ii) Technical resilience strategies deployed by fintechs, such as redundancy, encryption standards, and fraud monitoring, iii) Innovation trade-offs, identifying whether stringent compliance enhances trust and resilience but potentially slows down the pace of new payment solutions, iv) Cross-jurisdictional resilience outcomes, comparing EU fintechs to those in markets with lighter-touch frameworks.

Such empirical work mightdeepen understanding of “how” regulatory provisions translate into operational resilience for fintech companies providing technical services within the EU payment ecosystem. It would also better inform policymakers about the balance between safeguarding systemic resilience and maintaining an innovation-friendly regulatory environment.

Future research should include empirical case studies (e.g., examining fintechs’ performance during cyberattacks or during financial stress) and comparative quantitative studies of regulatory burden versus resilience outcomes in different jurisdictions.

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FINANCIAL RESILIENCE OF PUBLIC HEALTH IN THE REPUBLIC OF MOLDOVA

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Abstract:

The healthcare system, like other areas of the national economy, is constantly changing, driven by the development of medical techniques and technologies, improvements in medical performance, and the refinement of treatment techniques and methods. The improvement of medical management is a consequence of the development of medical processes and culture, which ultimately contributes to the improvement of the quality of medical services and the effectiveness of treatments, which is ensured on an ongoing basis through financial resilience in the healthcare system.

Financial resilience in medicine refers to the capacity of the health system to provide equitable and accessible services in the face of changes in certain socio-economic factors and economic, social, and epidemiological shocks.

The presented study proposes to conduct research on the current socio-economic situation in the Republic of Moldova, characterized by accelerated demographic changes and budgetary constraints, and to propose innovative economic and financial solutions to ensure the economic resilience of the healthcare system.

Based on the theoretical concept, financial resilience in health is perceived as the ability of the healthcare system to absorb economic, demographic, and epidemiological shocks while maintaining equitable access to healthcare services. In the Republic of Moldova, this issue is becoming increasingly important, given the current vulnerable situation created by objective political factors (the war in Ukraine) and subjective factors, such as demographic factors, including an aging population and the migration of medical personnel, which are also putting additional pressure on the financial sustainability of the healthcare system.

The research was based on official statistical data from NHIC 2021–2024, WHO, Index Mundi, Eurostat, and demographic reports from IPN, the National Bureau of Statistics, and specialized literature on informal payments and financial protection for patients (Stepurko et al., 2015).

The research methodology is expressed through the use of statistical research methods: comparative analysis of the medical system in the Republic of Moldova vs. Romania and the EU average); statistical-descriptive analysis of the evolution of health expenditure in the period 2000-2024; correlational method (the link between the level of funding and the degree of protection of households against catastrophic expenditure), as well as the institutional

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case study of budgetary payments to the NHIC by regional hospitals. The results showed a relatively low level of public health funding in Moldova (3.5–4.8% of GDP in 2023), which argues for the need to use direct private co-payments by the population. Approximately 17% of households face catastrophic expenditures, and 7% of the population remains below the poverty line due to medical costs. Although 88% of the population in the Republic of Moldova contributes to the mandatory health insurance system, the coverage provided remains only partial, while the persistence of informal payments and the limited list of reimbursed medicines continue to hinder equitable access to medical services and treatment.

In conclusion, we propose increasing the share of public health expenditures, strengthening governance and financial transparency, and developing innovative financing mechanisms — including public–private partnerships, performance-based funding instruments, innovation and prevention funds, and the earmarking of taxes on harmful products — in order to ensure the sustainability and equity of the health system. The Republic of Moldova needs coherent policies to reduce structural vulnerabilities and ensure the long-term financial resilience of public health. The financial resilience of health in the Republic of Moldova also depends heavily on the financial instrument of the money supply (to avoid inflation) and the relative stability of the national currency, which influences the costs of medical imports and the sustainability of external financing. EU countries with stable currencies and robust money supplies can finance health sustainably and absorb external shocks. The Republic of Moldova, with a smaller monetary base and a vulnerable leu, faces lower financial resilience, being dependent on the balance between the money supply and market demand for medical services, including the prices set for them.

Keywords: *public health, health policies, budget financing, direct payments, financial resilience*

JEL classification: *A1, I1, H51, P10*

Introduction

The financial resilience of the healthcare system refers to the ability of medical institutions to maintain the functionality and accessibility of services in the face of economic or demographic shocks (OECD, 2023). In the Republic of Moldova, this resilience is being tested by factors such as rising medical costs, an aging population, the migration of medical personnel, and the state's fiscal constraints. Following the COVID-19 pandemic and the energy crisis of 2022–2023, the Moldovan healthcare system was forced to adjust its expenditure structure, highlighting the need for proactive financial governance and the ability to absorb external shocks.

Theoretical framework

According to the literature (Kruk et al., 2017; Stepurko et al., 2015), financial resilience is based on three main pillars:

1. **Absorption capacity** – the system can maintain service levels in times of crisis;
2. **Adaptability** – adjustment of budgetary and institutional structures;
3. **Transformability** – reforming financing models to increase efficiency.

In the Republic of Moldova, the central for financing mechanism is the National Health Insurance Company (NHIC), which manages public funds for compulsory insurance. However, the budget structure remains vulnerable due to the low share of public expenditure and dependence on payroll contributions in an economy characterized by a high degree of informality (WHO, 2023).

Research methodology

This research adopts a quantitative-descriptive and comparative approach, aimed at assessing the relationship between the level of healthcare system funding and the degree of financial protection of the population in the context of the Republic of Moldova, compared to Romania and the European Union average. The empirical basis of the analysis consists of official statistical data from national and international sources – the National Health Insurance Company (NHIC, 2021–2024), the National Bureau of Statistics (NBS), Eurostat (2024), and the WHO Global Health Expenditure Database. These sources ensure the comparability and relevance of the indicators used, allowing for the identification of consistent trends at the macroeconomic and institutional levels. Methodologically, the research applies comparative analysis to highlight the structural differences between the health systems analyzed and **the correlational method (Pearson)** to determine the link between public health expenditure (% of GDP) and the proportion of households affected by catastrophic medical expenses (%). The results of the almost perfect negative correlation **($r = -0.9996$, $p < 0.05$)** confirm the direct interdependence between the level of public investment and the degree of financial resilience of the population.

Institutional case studies were also used to examine the mechanisms for financing and managing resources within the NHIC, and district hospitals, in order to understand the practical application of financial protection policies.

The main indicators analyzed include:

- public health expenditure (% of GDP);
- direct private expenditure (% of total health expenditure);
- proportion of households affected by catastrophic health expenditure (%);
- health insurance coverage (% of population).

By integrating these dimensions, the proposed methodology allows for the assessment of the resilience of the healthcare system from a multidimensional perspective, highlighting both the financial component and the social impact of health policies.

Results and comparative analysis

The analysis highlights a major structural gap between Moldova and the EU average. Public funding for health in Moldova is almost half the European average, and the share of direct private expenditure remains among the highest in the region (43%). (Table 1).

Table 1 Selected indicators of financial resilience (2021–2024), %

Country / Indicator	Public health expenditure (GDP, 2023)	Direct private expenditure (total)	Households with catastrophic expenses	Insurance coverage
Republic of Moldova	4,1	43	17	88
Romania	6,4	21	11	95
EU average	8,1	15	7	98

Source: NHIC (2024), OMS (2024), Eurostat Health Accounts (2024)

The phenomenon of informal payments, estimated at around 8–10% of total medical expenses (Stepurko et al., 2015), reduces transparency and affects patients' financial protection. In addition, 17% of households report medical expenses exceeding the threshold of 10% of disposable income, and 7% of citizens are pushed below the poverty line due to medical costs (WHO, 2024).

At the macroeconomic level, health financing is influenced by **currency stability** and the **national money supply**. The depreciation of the Moldovan leu by about 12% in 2022–2023 increased the costs of medical imports, reducing the efficiency of the NHIC budget.

Correlational analysis of financial resilience

In order to highlight the link between the level of public funding of the health system and the degree of financial protection of households, Pearson's correlation method was applied to the data available for 2023 for the Republic of Moldova, Romania, and the European Union average. The analysis was based on the following indicators: public health expenditure (% of GDP) and the proportion of households affected by catastrophic health expenditure (%), calculated in accordance with WHO methodology (Global Health Expenditure Database, 2024).

The statistical results revealed a **Pearson correlation coefficient** of r = -0.9996 (p = 0.018), indicating an almost perfect negative relationship between the two variables analyzed. In other words, as the share of public expenditure in GDP increases, the proportion of households bearing catastrophic medical expenses decreases significantly.

This relationship is empirically confirmed in the case of the three entities analyzed:

- Republic of Moldova – 4.1% of GDP allocated to public health, 17% of households affected;
- Romania – 6.4% of GDP, 11% of households affected;
- EU average – 8.1% of GDP, 7% of households affected.

The economic interpretation of these results highlights the fact that the level of public funding is a key determinant of the financial resilience of health systems. Insufficient allocation of public resources leads to increased household dependence on out-of-pocket payments, amplifying the risk of social exclusion and inequity in access to healthcare. In contrast, strengthening public funding correlates with better protection of the population and reduced economic vulnerability of households.

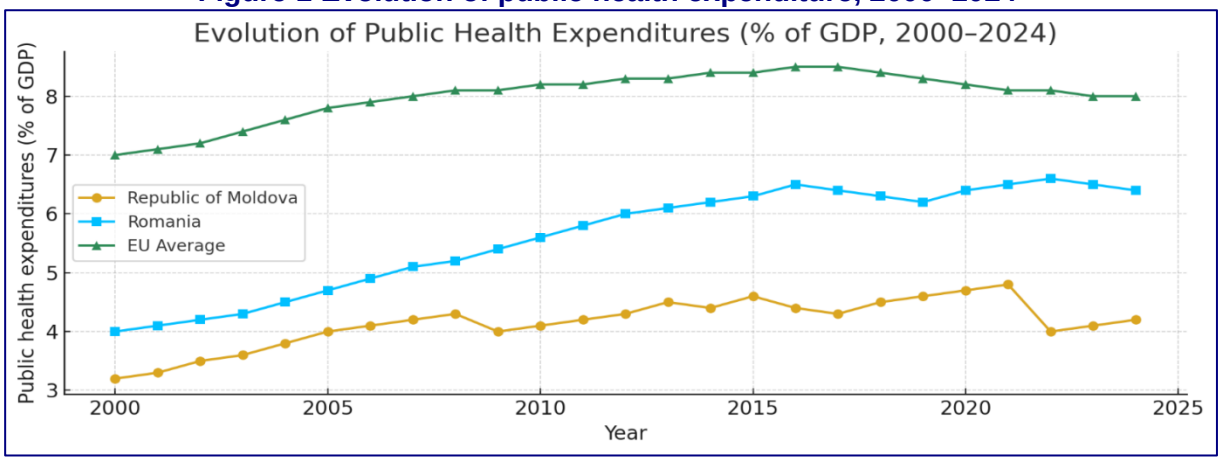
Therefore, the results support the hypothesis that the financial resilience of the healthcare system depends directly on the structure of funding sources and the share of state intervention in covering medical costs. In the context of the Republic of Moldova, a gradual

increase in public spending to the European minimum level could lead to a significant reduction in the financial pressure on the population, strengthening the equity and sustainability of the healthcare system.

The author mentions that Figure 1, illustrates a comparative evolution of public expenditure between 2000 and 2024, highlighting the persistent gap between the Republic of Moldova and European standards.

The interpretation of these data suggests that real financial resilience can only be achieved by increasing the share of public expenditure, while reducing the pressure of direct payments on households. Strengthening the role of the NHIC, and expanding drug reimbursement mechanisms would be essential measures to reduce current vulnerabilities.

Figure 1 Evolution of public health expenditure, 2000–2024



Source: prepared by the author based on data from NHIC (2024), WHO (2024), and Eurostat Health Accounts (2024)

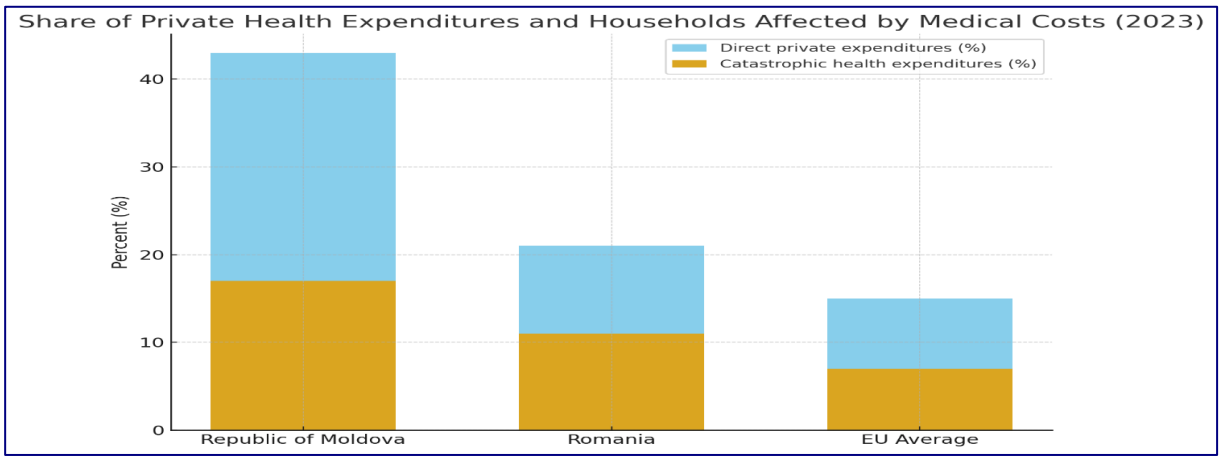
Comparative analysis of the structure of public and private health expenditure

The structure of healthcare financing in the Republic of Moldova reflects the balance between public and private contributions, which is a key indicator of financial sustainability and equity. A comparative analysis Republic of Moldova, Romania, and the European Union average for the period 2020–2024 highlights significant differences in the share of public and private spending in total healthcare expenditure.

According to WHO (2024) and Eurostat (2024) data, public health expenditure in the Republic of Moldova accounts for approximately 56–58% of total expenditure, while direct private expenditure (out-of-pocket) exceeds 42%, which is considerably above the European average of 15–18%.

In Romania, the structure is somewhat more balanced, with public spending accounting for 70% and private spending for 30%, but still far from the European Union model, where public funding exceeds 80–82%.

Figure 2 Share of out-of-pocket expenditures and households affected by catastrophic health expenditures in Moldova, Romania, and the EU average (2023)



Source: prepared by the author based on data from NHIC, (2024), WHO (2024), Eurostat Health Accounts (2024)

These discrepancies reflect a low level of financial protection in the Republic of Moldova, where the population bears a significant portion of medical costs through direct payments, including informal payments and unofficial contributions. As a result, the health system is exposed to the risk of chronic underfunding, and access to medical services becomes dependent on individual income and geographical location.

Figure 2, highlights two key dimensions of financial vulnerability in health systems: the share of out-of-pocket expenditures and the proportion of households facing catastrophic health expenditures.

The data show that Moldova has the highest values in both categories. Out-of-pocket expenditures account for 43% of total health expenditures, reflecting the system's significant dependence on population contributions. At the same time, 17% of households incur catastrophic health expenditures, i.e., exceeding the threshold of 10% of disposable income. By comparison, Romania has moderate values—21% for direct expenses and 11% for affected households—which shows a better level of financial protection for patients, but still below European standards.

In the European Union, the average share of private expenditure is 15%, and only 7% of households bear catastrophic costs, confirming the effectiveness of health insurance systems and compensation schemes.

The comparative analysis thus reveals a systemic gap between the Republic of Moldova and European standards, with direct effects on the equity and financial sustainability of the healthcare system. The high level of out-of-pocket payments is determined both by the limited list of reimbursed medicines and by the persistence of informal payments in hospitals, which indicates fragilef inancial resilience of households and excessive dependence on individual contributions.

Demographic analysis and impact on the financial sustainability of public health

The financial resilience of the healthcare system cannot be analyzed in isolation from demographic trends, which determine the pressure on public spending and the need for

medical services. In the Republic of Moldova, demographic dynamics are marked by the accelerated aging of the population, declining birth rates, and the external migration of medical workers, phenomena that amplify the vulnerability of the healthcare system.

According to the National Bureau of Statistics (NBS, 2024) and Eurostat (2024), the proportion of the population aged over 65 increased from 10.8% in 2000 to 17.3% in 2024, while the share of the working-age population (15–64 years) decreased from 68.1% to 61.4%. This structural transformation is leading to an increase in the demographic dependency ratio, from 38 to 52 elderly people per 100 working-age people, which means additional pressure on public finances, particularly on the Compulsory Health Insurance Fund (CHIF).

On the other hand, the migration of medical personnel is a factor in the institutional erosion of the system's resilience. NHIC data (2023) show that, in the last five years, the Republic of Moldova has lost over 22% of its specialist doctors and 18% of its nurses through external migration, mainly to Romania, Germany, and Italy. This professional exodus reduces the system's ability to respond to epidemiological shocks (such as the COVID-19 pandemic) and affects the efficient use of internal financial resources.

A comparative analysis with Romania and the EU average shows that countries with a more balanced demographic structure and a stable medical workforce manage to maintain greater financial resilience, even in the face of external economic pressures. In the case of the Republic of Moldova, demographic vulnerabilities amplify the impact of budget constraints, leading to a spiral of underfunding – exodus – inefficiency – vulnerability.

To counteract these trends, integrated policies are needed that combine measures to retain medical staff, incentives for young professionals, and investments in rural health infrastructure. At the same time, the development of automatic financial adjustment mechanisms (indexing NHIC funds to inflation and GDP growth) would ensure the long-term sustainability of the system.

Discussion

The study of the interdependence between macroeconomic factors and health system financing highlights that monetary stability is one of the fundamental conditions for ensuring the sustainability of public spending and the financial protection of the population. In the context of the Republic of Moldova, where the economy is small and highly dependent on imports, the dynamics of the money supply and the exchange rate directly influence both the costs of medical services and the government's ability to ensure an adequate level of public financing.

Money supply (M1, M2) and health financing

Expanding the money supply through stimulative monetary policies can help increase the amount of resources available for health care, encouraging investment in infrastructure, equipment, and public health programs. However, in the absence of a correlation with economic productivity, this expansion can generate inflation, including medical inflation — a phenomenon that consists of accelerated price increases for medicines, medical devices, and healthcare services. In the Republic of Moldova, where the money supply is limited and the medical market is heavily dependent on imports, any uncontrolled monetary expansion tends to be reflected in the costs borne by the population, increasing the pressure on out-of-pocket expenses. The government's ability to increase public spending on health thus

remains conditional on a delicate balance between monetary and fiscal policy and dependence on external financing.

Exchange rate and impact on medical costs

Exchange rate fluctuations are a major determinant of healthcare costs. Moldova imports most of its medicines, equipment, and medical supplies, which means that the depreciation of the Moldovan leu (MDL) against major international currencies (the euro and the dollar) has an immediate effect on price increases. This dynamic amplifies budgetary pressure on medical institutions and reduces the accessibility of services for the population. In addition, projects financed by external grants and loans become more expensive in the repayment phase, affecting the financial sustainability of the sector. Therefore, currency stability becomes an essential condition for maintaining the balance between internal and external financing of the healthcare system.

Macroeconomic correlation and implications for the resilience of the healthcare system

In the developed economies of the European Union, currency stability and a solid monetary base enable sustainable health financing, reducing vulnerability to external shocks and keeping catastrophic household expenditure low. In contrast, the Republic of Moldova faces limited financial resilience, driven by the fragility of the national currency and dependence on external financial flows. This situation means that the effectiveness of health policies depends on the ability of the National Bank of Moldova (NBM) to manage the money supply without generating inflation and on the government's ability to ensure a stable exchange rate. Compared to Romania and the EU average, the Republic of Moldova has a low degree of financial resilience, determined by: This situation means that the effectiveness of health policies depends on the ability of the National Bank of Moldova (NBM) to manage the money supply without generating inflation and on the government's ability to ensure a stable exchange rate.

- the low share of public financing (below 5% of GDP);
- inefficient collection of compulsory insurance contributions;
- high dependence on external financing and donors;
- demographic imbalances and migration of specialists.exchange rate.

However, there is visible progress: digitization of NHIC processes, ongoing hospital reform, and a gradual increase in the public health budget (+22% between 2020 and 2024).

The author proposes that in order to strengthen financial resilience, it is necessary to:

1. expand the base of active taxpayers;
2. ensuring transparency of informal payments;
3. develop public-private partnerships in medical infrastructure;
4. create a reserve fund for major health shocks.

Conclusions

The financial resilience of the healthcare system is a fundamental condition for the sustainability of medical services in a context of multiple crises—economic, social, and epidemiological. The study analyzes the evolution of the financial resilience of public health

in the Republic of Moldova between 2000 and 2024, through comparative reporting with Romania and the European Union average. The research highlights the structural vulnerabilities of financing, the impact of budgetary constraints and dependence on external support, but also directions for strengthening financial sustainability.

The financial resilience of Moldova's healthcare system is limited but can be improved. Its consolidation depends on increased public funding, macroeconomic stability, and structural reforms in fund management.

In the long term, sustainability can be achieved by integrating performance-based financing mechanisms; adapting fiscal policies to demographic risks; and coordinating monetary policy (NBM) with health policy to stabilize medical costs.

Thus, the Republic of Moldova is undergoing a financial transition, in which the healthcare system must strike a balance between economic efficiency and social protection. This transition requires not only an increase in public funding, but also optimisation of resource management, institutional transparency and the integration of modern financial monitoring tools.

The relationship between money supply, exchange rates, and health financing reflects a complex balance between macroeconomic stability and social objectives. In the case of the Republic of Moldova, strengthening the financial resilience of the health system requires a prudent monetary policy geared towards controlling inflation and maintaining exchange rate stability. Only such an approach can guarantee the sustainability of health financing and protect the population against the financial risks generated by internal and external economic shocks.

In conclusion, demographics are a crucial determinant of financial resilience. Without an active population base and a stable medical workforce, any increase in public funding risks being only temporary. Thus, the financial resilience of public health in the Republic of Moldova depends directly on the correlation of demographic, social, and economic policies within a strategic framework for sustainable development until 2030.

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THE POTENTIAL OF DIGITAL TECHNOLOGIES IN THE DEVELOPMENT PROCESS OF COMPANIES

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Abstract:

The main objective is to highlight the contribution of digital technologies to the sustainable development of companies in the manufacturing industry. Based on the consultation of numerous specialized works and the processing of available data, it was found that although companies embrace digitalization, they encounter obstacles in terms of integrating digital technologies. In the context of the presented aspects, the most appropriate solutions capable of ensuring the elimination of barriers and ensuring long-term performance are identified.

Keywords: *digitalization, technology, competitiveness*

JEL classification: *L23, O3, O30*

Introduction

Companies, regardless of their sector of activity, are facing increasing pressure to integrate digital solutions in order to remain competitive. Digital transformation is not just a technological process, but also a strategic and cultural change that affects the way they operate, interact with customers and generate value.

One of the most obvious contributions of digital technologies is increased operational efficiency. Process automation or the use of artificial intelligence solutions in data analysis helps reduce costs and minimize human error.

Digital transformation is one of the main drivers of economic and organizational progress. Digital technologies are not only supporting tools, but true engines of innovation, competitiveness and adaptability. In the context of fierce competition, this study aims to highlight the importance of integrating and leveraging digital technologies in manufacturing companies, the obstacles they face, and the solutions they should adopt to remove these barriers.

Literature Review

In the immediate future, the ascent of digital platforms will be significant and the role of transparent systems that reduce uncertainty will be decisive. Presenting digital opportunities

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and introducing them into the business sector are also essential and will contribute significantly to increasing the competitiveness of companies (Kovács et al., 2021).

As some studies show, artificial intelligence could replace human resources, especially in sectors where repetitive tasks are common (Monaro et al., 2022), with approximately a quarter of current work tasks being automatable (Hatzius et al., 2023). Therefore, it is predicted that the average level of automation of current work tasks through digitalization will be achieved between 2030 and 2060 (Chui et al., 2023).

Hashmi (2023) considers understanding the importance and role of digitization to be fundamental, and according to Enholm (2021), the integration of digital technologies can have a strong impact on companies' financial and operational performance.

Companies are optimistic about the integration of artificial intelligence and the role that employees will play within companies. Mainly, there is an expectation that the two concepts will be treated in an integrated vision, at least for a significant period of time (Brock and Von Wangenheim, 2019).

Aggarwal et al., (2022) highlighted the essential role of artificial intelligence-based applications in the operational performance of companies, enabling better management of operational costs and leading to higher profits. These can be used in production planning, determining future requirements, and optimally configuring production lines (Jónás et al., 2014).

McKinsey&Company's study highlights the importance of implementing strategies that allow businesses to integrate advanced technologies into innovative business models, with the primary goal of increasing competitiveness (Banlholzer et al., 2023).

The auto industry, one of the most important industrial sectors, has faced significant changes. This is the area where digital technology has penetrated the most easily, with artificial intelligence transforming automobile factories into *intelligent factories* (Tăpîrdea et al., 2021). Sustainable development has become a primary goal, with a focus on developing vehicles with zero carbon emissions (Dumitrașcu et al., 2020).

Methodology and Data

Adopting digital solutions significantly improves the manufacturing, supply and distribution processes, ensuring more transparency and control over operational flows.

The primary objectives of the European Union are the digital transformation of thecompanies by 2030. 90% of IMMs should have at least a basic level of digital intensity and 75% of EU companies should use cloud computing services, big data analysis or artificial intelligence.

Despite the fact that digitalization facilitates expansion into international markets, according to Eurostat, in 2024, just 3.1% of romanian companies would use advanced digital technologies, placing Romania last among EU member states (the average is 13%).

The success of digitalization depends on a balance of technological investments, human resource development and organizational culture change. In a competitive environment that is constantly changing, digital technologies are those that ensure sustainable development. As a result, based on the data and information provided by *Renault Group Romania*, the factors that determine the performance of *Automobile Dacia* are highlighted.

Results

Automobile Dacia was founded in 1960, on the basis of a partnership between the Romanian state and the French National Renault Companyand has its origins in the *Pitești Automobile Factory*.

In 1999, the *Dacia Factory* was privatized and purchased by Renault, which acquired 51% of its capital. Currently, the majority stake is held by *Renault Group* with 25,271,553,077 shares (99.43%) which includes multiple subsidiaries and constitutes a multinational group based in France.The company's goal is to produce, at its Mioveni factory, high-quality passenger and commercial vehicles that are affordable for romanian and foreign customers.

The success of the *Dacia* brand is based, among other factors, on satisfying customer requirements to the highest possible standard and on the high quality/reliability of its vehicles.

The company's evolution requires, above all, knowledge and implementation of the digitization process. The Mioveni factory has reached a degree of automation of approximately 60%. In this regard, an important role is played by robots, part of the automated production flow that presses, welds and transports parts. In the *Pressing Department*, steel sheets are cut to millimeter precision, their shape being calculated by software in such a way as to minimize sheet waste. Approximately 800 tons of sheet metal are processed daily. The cut shapes are then sent to automatic presses that mold the sheet metal into future doors, hoods or roofs.

The department has benefited from significant investments in automation, which began in 2013 when the first automatic press line was installed. In 2023, only two lines were still manual, and in 2025, following an investment of 36 million euros, all presses were robotized, which led to a reduction in the number of employees (from 700 to 400 in the last two years). Some of them were trained and reassigned to maintenance and robot-related jobs. It is also expected to replace 10-14 employees working in the verification operation department, with robots, following an investment of approximately 5 million euros.

In the *Car Body Department*, where vehicle components are welded, there are 1400 employees and over 550 industrial robots manufactured by Kuka and ABB. The automation rate in this department has reached 60%, with only 40% of the work being done manually. Industrial robots with artificial intelligence systems or video monitoring measure the quality of the welding. If the welding does not respect the quality standards, the line stops automatically and an operator intervenes to fix the problems.The entire vehicle manufacturing process takes approximately 10 hours. The body line can produce 40 vehicles per hour.

In *Logistics*, another 270 autonomous AGV (Automated Guided Vehicle) robots, without human operators and priority of passing, transport parts from one place to another.

Automobile Dacia is embracing a comprehensive process of profound transformation of the entire industrial system through digitalization in order to reinvent automobile production.In order to train employees in ICT and digital skills it implemented the *Digitization for Change project* between May 31, 2021, and May 30, 2023. The project, co-financed by the European Union and the Romanian State from the European Social Fund through the Human Capital Operational Program 2014-2020, involved 367 employees (139 men and 228 women). Of the total number, 365 were certified. In addition, 31 employees aged between 55 and 64 were trained.The employees developed advanced ICT skills and basic digital skills, which will add value to the company's activity.

The specialized nature of the 44 programs implemented will enable the development of new digital solutions, products or services at the company level.*The Digitalization in Maintenance* project, implemented during the same period, involved 292 employees (146 men and 146 women), of whom 291 were certified. In addition, 51 employees aged 55-64 were trained.

Between June 9, 2021, and June 8, 2023, *Renault Technologie Roumanie* (RTR) implemented the *Digital Training for SMART Engineering* project. A total of 263 employees (202 men and 61 women) participated in the 25 professional training programs, all of whom were certified.

The automotive production transformation plan, *Re-Industry*, which will reduce industrial costs for thermal vehicles by 30% and for electric vehicles by 50% by 2027, will also contribute to reducing vehicle development time from three to two years. The *Renault Group* is accelerating its digitalization with the first *Industrial Metaverse* (a digital space based on physical simulations, combining virtual reality (VR), augmented reality (AR), digital twins and other technologies to optimize processes, remote collaboration and testing without major physical investments). Launched in 2022 at the Flins factory in France, the system which is connected to 100% of production lines (8500 pieces of equipment), 90% of supply flows, and absolutely to all data in the supply chain, has reduced delivery times by 60%, carbon footprint by 50%, and enabled savings of 320 million euros.The system is divided into four fundamental pillars:

1. *Massive data collection* – The *Renault Group* has connected all production lines (equipment and workstations) and developed a platform in partnership with IT company ATOS to develop unique technological solutions for large-scale manufacturing data collection and analysis;
2. *Digital Twins* – digital replicas of factories, processes and supply chain components that enable monitoring, simulation and control;
3. *Extended ecosystem* – includes external data (data on suppliers, transport, quality, sales forecasts, exogenous factors) for predictive planning and the adoption of solutions to avoid possible disruptions;
4. *Advanced technologies* – use of cloud, AI, Big Data, 3D/VR/AR, communication networks (Wi-Fi/mobile), immersive training tools, real-time control platforms.

Every day, one billion pieces of data are collected at industrial sites. *Metaverse Industrial* monitors industrial operations in real time, ensuring increased efficiency and quality of production and supply chain.

For an environmentally friendly ecosystem, *Renault Group* constantly monitors all energy consumption through the *Ecogy* portal and reacts immediately in case of deviation. It is aiming for a 40% reduction in energy consumption by the end of the year and, in terms of emissions, is targeting Net Zero Carbon for *the ElectriCity* hub and the *Cléon*factory by the end of the year, for its factories in Europe by 2030 and for its factories worldwide by 2050.

The *Renault Group's* industrial system currently uses 300 operational artificial intelligence applications that respond to the growing challenges of image and sound analysis and aims to increase this number by 3000 applications by the end of the year.

It is well known that digitization plays an essential role in the development of companies and the integration of digital technologies into internal operations brings substantial benefits to them, such as: *increased visibility and control* – real-time monitoring of operations, detection of deviations, proactive interventions; *operational efficiency* – reduced production time, optimised resource utilisation; *sustainability* – energy consumption monitoring, emissions optimisation and carbon footprint reduction; *better quality* – reduced errors, improved quality control processes; *flexibility and accelerated innovation* – testing capabilities.

The integration of digital technologies within companies brings numerous major benefits but also significant obstacles: *organizational* – employee resistance to change; rigid organizational culture, poor internal communication between departments, lack of digital leadership (management does not have a clear digital transformation strategy); *financial* – high implementation costs (equipment, licenses, maintenance); difficulties in attracting financing or funds for digitization projects; *technological* – lack of adequate digital infrastructure (incompatibility between new and old systems), cybersecurity issues; *human* – lack of digital skills, need for continuous training, fear of automation (perception that digitization reduces the number of jobs); *cultural* – rigid organizational culture, reluctance to share data and information, low level of trust in digital technologies; *external factors* – legislative and fiscal framework insufficiently adapted to digital transformation, lack of strategic partnerships with technology companies, shortage of IT specialists, automation, etc., complex regulations – data protection rules, competitive pressure, volatility of the technology market.

Conclusions

This article aimed to highlight the contribution of digitization to improving company performance.

Digitization plays a decisive role in maintaining and increasing competitiveness, the need for which is highlighted by the complexity of the economic activities of companies under the strong influence of international markets.

In this context, the implementation of digital technologies becomes a *sine qua non* condition for companies to withstand competition.

Although the topic has been addressed in numerous reference works, it remains a topical and interesting subject, and further study is imperative given that many companies are reconfiguring their positions in a market where the role of digitization is becoming increasingly important.

Identifying the challenges faced by many companies requires outlining the main courses of action for increasing the contribution of digital technologies:

- *Strategic and planned investments* – developing a phased digital modernization plan; prioritizing critical sectors for gradual modernization;
- *Accessing European funds and government programs for digitization* – National Recovery and Resilience Plan (PNRR) – Component C7 – Digital Transformation, Digital Europe Program (DEP), Horizon Europe, EIT Digital;
- *Adopting cloud solutions* – cloud services such as: IaaS (Infrastructure as a Service); PaaS (Platform as a Service); SaaS (Software as a Service); BaaS/DaaS – reduce initial costs through monthly subscriptions instead of massive investments in infrastructure; offer increased security, automatic updates, global accessibility;
- *Partial outsourcing of IT services* – instead of building costly internal teams, companies can collaborate with specialized partners;
- *Collaboration with IT companies and digital solution providers* to implement modern infrastructure;adopting common protocols to facilitate communication between equipment and applications;
- *Human resources training* – developing a training plan (setting employee training objectives, selecting training methods; partnerships with universities or digital innovation

centers to attract talent); continuous assessment and improvement (monitoring performance after training, assessing the impact on productivity and quality); creating an organizational culture geared towards digital innovation;

- *Implementation of a cybersecurity plan* by establishing clear rules on data access, passwords, multi-factor authentication, regular backups; use of modern firewalls, AI-powered antivirus software, intrusion detection systems (IDS/IPS); continuous network monitoring; compliance with regulations (GDPR)

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TRANSFORMING DEVELOPMENT: CIRCULAR ECONOMY AND ECONOMIC GROWTH IN THE GLOBAL SOUTH

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Abstract:

The article explores the intersection of circular economy (CE) and economic growth in developing countries, with a particular focus on Africa. It argues that CE is more than a technical framework for waste management – it is a transformative model that can foster industrial innovation, strengthen resilience, and promote inclusive development. Drawing on theoretical debates, comparative regional experiences, and case studies from Africa, the paper shows how CE contributes to employment creation, resource efficiency, and competitiveness. At the same time, structural constraints such as weak infrastructure, limited financing, and fragmented governance hinder its expansion. By analysing these dynamics, the article identifies conditions under which CE can support sustainable growth and highlights policy priorities, including integration of the informal sector, access to finance, and coherent national roadmaps for inclusive and resilient transitions.

Keywords: *circular economy, economic growth, sustainable development, developing countries, Africa*

JEL classification*: O55, 056, O13*

Introduction

The global economy today is undergoing profound structural transformations, driven by the combined pressures of sustainability, technological change, and geopolitical realignments. Among these forces, ecological sustainability stands out as both a challenge and an opportunity. While economic growth has traditionally been measured by expanding production and consumption, this paradigm is increasingly questioned in the face of climate change, resource depletion, and environmental degradation. As a result, sustainability is no longer perceived as a peripheral or optional consideration but as a central determinant of competitiveness, investment flows, and long-term resilience (Bobeва et al., 2023; Spasova, 2024; Zhelyazkova, 2024).

The shift towards sustainability has begun to reshape global value chains and trade relations. Businesses and consumers alike are placing growing emphasis on environmentally responsible practices, compelling firms to integrate eco-efficiency, responsible sourcing, and resource regeneration into their core strategies. This trend is mirrored in the rise of green

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trade policies and environmental standards, including carbon border adjustment mechanisms, eco-design requirements, and stricter traceability rules for global supply chains (Zhelyazkova, 2020). For states and enterprises that adapt to these shifts, sustainability represents a source of competitive advantage in accessing global markets and attracting investment. Conversely, for those that fail to align with the new paradigm, risks of marginalization and exclusion intensify (Sabotinova, 2020).

The vulnerabilities of global supply chains further underline the urgency of systemic transformation. Climate-related risks – such as extreme weather events, droughts, and resource scarcity – are rendering international production networks increasingly fragile (Zhelyazkova, 2017). These pressures have spurred governments and firms to reconsider their reliance on traditional linear trade and production models. Emerging responses include the adoption of circular economy (CE) practices, sustainable logistics, and innovations that reduce dependency on volatile global resource markets.

Within this context, circular economy has gained prominence as a framework capable of reconciling economic development with environmental imperatives. CE emphasizes lower material throughput, product life-cycle extension, closed-loop value chains, and the minimization of waste (Dimova&Karpuzova, 2024). It thus offers a viable pathway to harmonize trade, production, and consumption with the goals of sustainable development (Kotseva-Tikova&Mochurova, 2025). Beyond its ecological rationale, CE increasingly functions as a strategic economic model, enabling states and firms to strengthen resilience, foster innovation, and capture new market niches.

For developing countries, the promise of CE is particularly significant. These economies face the dual challenge of addressing entrenched development needs – employment creation, poverty alleviation, industrial upgrading – while simultaneously responding to global pressures for environmental compliance and sustainability. In many cases, circular approaches already align with local traditions of repair, reuse, and community-led resource management, which can be leveraged into competitive advantages on the global stage. At the same time, structural constraints such as limited access to finance, technological gaps, and institutional fragmentation hinder the scaling up of CE initiatives (UNECA, 2024; UNCTAD, 2023).

Africa provides a striking example of this dynamic. Although the continent contributes less than 4 percent of global greenhouse gas emissions, it is disproportionately affected by climate change impacts, including desertification, recurrent flooding, and food insecurity (IEA, 2023; UNECA, 2024). Circular economy models are increasingly recognized by African governments, regional organizations, and entrepreneurs as tools to mitigate environmental vulnerabilities while promoting inclusive growth and industrial transformation. Experiences from countries such as Kenya, Rwanda, and South Africa illustrate the potential of CE to generate employment, support small and medium-sized enterprises, and strengthen local value chains (Muriithi&Ngare, 2023; GIZ, 2023).

Yet, critical questions remain regarding the type of growth CE can stimulate in developing contexts. Scholars caution that circular transitions may risk “innovation without inclusion” if benefits are disproportionately captured by large firms or external markets, leaving local actors marginalized (Schröder et al., 2019; Käsner et al., 2023). This underscores the importance of situating CE within broader frameworks of inclusive sustainability – where resource efficiency and industrial innovation are pursued alongside equity, access, and social justice.

This article examines the relationship between circular economy and economic growth in the context of developing countries. It does so by situating CE within the broader structural

transformations of the global economy, identifying both opportunities and risks for developing states, and reflecting on empirical illustrations from Africa. By analyzing sustainability as a transformative determinant of trade, investment, and production patterns, the study argues that CE should not be viewed solely as an environmental agenda but as a strategic imperative for inclusive, resilient, and competitive development.

Sustainability and Structural Changes in the Global Economy

The global economy is in the midst of profound structural shifts. Among the key drivers of these transformations, sustainability has emerged as a central and irreversible determinant. Once considered an ancillary or voluntary aspect of corporate and policy agendas, sustainability has become a cornerstone of both economic strategy and competitive positioning (Sabotinova, 2020). This is not only because of the urgent environmental crises associated with climate change, biodiversity loss, and resource depletion, but also because sustainability is now directly tied to access to markets, investment opportunities, and long-term industrial resilience (Spasova, 2024; Zhelyazkova, 2024).

The interconnected nature of ecological, social, and economic sustainability makes this transformation even more complex. For developing regions in particular, sustainability cannot be reduced to environmental concerns alone. It must be understood as a nexus that also encompasses employment creation, access to resources, poverty reduction, and equity (Bobeва et al., 2023). The green transition, therefore, is not merely about lowering carbon emissions but about reconfiguring development models so that they integrate ecological imperatives with social and economic inclusion.

The growing awareness of sustainability is reshaping global value chains in ways that have significant implications for both developed and developing economies. Firms are under mounting pressure from regulators, investors, and consumers to adopt eco-friendly practices across production, sourcing, and distribution. The proliferation of environmental trade policies – such as carbon border adjustment mechanisms (CBAM), eco-design directives, and mandatory traceability standards – illustrates how sustainability considerations are being hardwired into international trade regimes (Zhelyazkova, 2020).

For enterprises in both developed and developing countries, this shift implies that competitiveness increasingly depends on the ability to demonstrate sustainable practices. Countries that succeed in greening their production systems are better positioned to attract investment, diversify export opportunities, and avoid exclusion from emerging green trade frameworks. Conversely, those that lag risk being marginalized in global markets where sustainability standards act as de facto trade barriers (Spasova, 2024).

This transformation also highlights the role of consumer demand. A growing segment of global consumers now prioritize sustainable products and services, rewarding firms that incorporate transparency, ethical sourcing, and eco-efficiency. This consumer-driven dynamic reinforces regulatory pressures, creating a feedback loop that accelerates the integration of sustainability into economic practices (Bobeва et al., 2023).

Sustainability has also become an imperative due to the growing vulnerabilities of global supply chains. Climate change manifests through extreme weather events, floods, droughts, and rising sea levels – all of which disrupt production and logistics. Resource scarcity, particularly in water, energy, and critical raw materials, further amplifies the fragility of supply chains (Zhelyazkova, 2017).

In response, both firms and governments are rethinking their dependence on long, globalized supply networks. Shorter, more resilient, and regionally embedded value chains are

increasingly favored. Green logistics, responsible sourcing, and CE-inspired closed-loop systems are becoming central strategies for mitigating risks associated with global disruptions. For developing countries, this trend offers both risks and opportunities. While they may face exclusion if unable to meet stringent standards, they can also benefit from regional integration and localized production systems that reduce dependency on volatile global markets.

The concept of "sustainable practices" has broadened significantly over the last two decades. It now encompasses a wide array of measures: eco-friendly production technologies, energy-efficient transportation, ethical sourcing, compliance with stringent environmental regulations, and more (Georgieva &Brunzova, 2024). As Angelova (2024) argues, sustainability is no longer confined to compliance with regulations or corporate social responsibility. It has evolved into a strategic imperative, enabling firms to align with changing consumer preferences and regulatory demands while minimizing long-term ecological risks.

This strategic shift is equally relevant at the macroeconomic level. States that integrate sustainability into industrial and trade policies are in a stronger position to attract "green" investment flows, access climate finance mechanisms, and participate in the emerging global architecture of sustainable trade. In this sense, sustainability functions as both a competitive differentiator and a resilience-building tool in an increasingly uncertain global economy (Spasova, 2024; Zhelyazkova, 2024).

Within this broader transformation, circular economy has emerged as one of the most promising frameworks for aligning economic activity with sustainability goals. CE promotes reduced material intensity, life-cycle extension of products, minimization of waste, and the establishment of closed-loop value chains (Dimova&Karpuzova, 2024). It encourages businesses to rethink not only how goods are produced and consumed but also how they are designed, reused, and reintegrated into production cycles.

At the global level, CE has been increasingly recognized as a development strategy rather than simply an environmental agenda. Kotseva-Tikova and Mochurova (2025) argue that CE provides a viable model for harmonizing trade, production, and consumption with the objectives of sustainable development. By reducing resource dependency, CE strengthens resilience against external shocks such as price volatility or supply disruptions. It also opens new avenues for innovation and competitiveness, particularly in industries like renewable energy, waste management, and sustainable agriculture.

For developing economies, the global turn towards sustainability and CE presents both opportunities and systemic challenges. On the one hand, CE models align with longstanding practices of reuse, repair, and community-driven resource management, which are deeply embedded in many local contexts. These traditions can serve as the foundation for innovative and competitive CE systems (UNECA, 2024; UNCTAD, 2023). Moreover, circular models offer solutions to chronic development issues such as youth unemployment, overreliance on resource extraction, and the expansion of informal economies (Marinov, 2025; IWMI, 2024).

On the other hand, developing countries face structural constraints that hinder the scaling up of CE initiatives. These include limited access to finance, insufficient technological capacity, weak institutional coordination, and fragmented policy frameworks (UNECA, 2024). Without targeted support, CE risks reinforcing inequalities, leading to what Schröder et al. (2019) describe as "innovation without inclusion." For example, while multinational firms may benefit from high-value CE sectors such as renewable energy or advanced recycling, local entrepreneurs may struggle to compete or capture value.

African experiences exemplify these dynamics. Countries such as Rwanda and Kenya have adopted national roadmaps for CE, investing in e-waste management, sustainable agriculture, and renewable energy (Muriithi&Ngare, 2023). South Africa has experimented with integrating CE principles into industrial clusters, while grassroots innovations in Nigeria and Ghana have leveraged informal recycling networks to address waste challenges. These cases highlight both the transformative potential of CE and the structural obstacles to scaling it beyond pilot projects.

Ultimately, sustainability is becoming the organizing principle of a new global economic paradigm. It is not only about mitigating environmental risks but also about reconfiguring the rules of competition, trade, and investment. As Karpuzova (2022) observes, in an era of intensifying ecological risks and rising consumer awareness, sustainability considerations are no longer peripheral – they are central to the architecture of a future-oriented global economy.

The strategic integration of sustainability into business models, trade frameworks, and national development strategies is thus a necessity, not a choice. For developing countries, this requires a dual approach: aligning with global standards to maintain competitiveness while tailoring CE models to local socio-economic realities. By doing so, they can ensure that sustainability-driven transformations not only reduce environmental pressures but also foster inclusive, equitable, and resilient growth.

Circular Economy and Economic Growth in Developing Countries

For much of the 20th century, economic growth was understood primarily through a neoclassical lens: increased production and consumption were equated with progress and prosperity. This model, however, is increasingly untenable in the face of climate change, biodiversity loss, and material resource limits. Traditional linear growth patterns – characterized by extraction, production, consumption, and disposal – now clash with planetary boundaries. In this context, scholars of sustainable development stress the need for “absolute decoupling” of growth from resource use, a goal achievable only through systemic transformation of economic models (Schröder et al., 2019; Ellen MacArthur Foundation, 2021).

Circular economy is positioned as precisely such a transformative model. By emphasizing efficiency, reuse, repair, and recycling, CE reconfigures growth to align with environmental and social imperatives. Rather than maximizing throughput, CE seeks to maximize value creation within ecological limits. It is not merely a technical framework but a new developmental paradigm with the potential to reconcile economic aspirations with sustainability goals.

Several studies indicate that CE adoption can generate measurable contributions to GDP and employment in developing contexts. An OECD (2019) analysis suggests that circular practices – particularly improved material efficiency, repair industries, and recycling – can add up to 2% of long-term GDP growth. By reducing resource imports and strengthening domestic value chains, CE offers a strategy for resilience against global shocks.

Similarly, UNIDO (2024) emphasizes the role of national CE roadmaps as vehicles for balancing industrial transformation with sustainable growth. These roadmaps not only create regulatory certainty but also foster investment in emerging CE sectors such as renewable energy, waste valorization, and bio-based industries. By expanding employment in repair, remanufacturing, and recycling, CE provides opportunities for both skilled and unskilled labor markets.

The World Economic Forum (WEF, 2022) further highlights that growth derived from circular innovations is less vulnerable to global disruptions. Shorter and more localized supply chains, combined with resource efficiency, reduce exposure to volatile commodity prices and international logistics shocks. For developing economies, this "resilience dividend" is particularly valuable, as they are often disproportionately affected by external crises.

While CE offers opportunities, scholars caution against assuming a universal "win–win" outcome. Schröder et al. (2019) warn of the risk of "innovation without inclusion," where CE-driven growth may reproduce existing inequalities. High-value circular activities, such as advanced recycling or renewable technology manufacturing, may be dominated by multinational corporations, while local firms and informal workers remain excluded.

Käsner et al. (2023) add that in the Global South, CE practices often emerge informally and without adequate institutional support. While these practices contribute to resource efficiency, they may also expose workers to hazardous conditions and economic precarity. The challenge, therefore, is not merely whether CE contributes to growth, but what kind of growth it produces: inclusive, equitable, and sustainable – or exclusionary and dependent.

This debate underscores the importance of embedding CE policies in social frameworks that prioritize equity, labor protection, and community empowerment. Without such safeguards, CE risks reinforcing asymmetries between developed and developing economies, as well as within societies.

Structural constraints in developing countries

Despite its potential, CE in developing countries faces systemic barriers that limit its capacity to drive growth. Four interrelated constraints are particularly significant:

1. Capital shortages and financial exclusion.Small and medium-sized enterprises (SMEs), which are often the main CE innovators, struggle to access financing. Credit requirements, lack of collateral, and high borrowing costs hinder investment in recycling facilities, renewable energy, or eco-design. Without targeted instruments – such as microcredit, blended finance, or green bonds – the scaling of CE is severely constrained (UNECA, 2024).
2. Technological gaps.Advanced CE models often rely on sophisticated technologies – such as chemical recycling, digital traceability, or industrial symbiosis platforms – that remain out of reach for many developing economies. The reliance on imported technologies increases costs and risks of poor adaptation to local contexts, leading to failed or unsustainable projects (Käsner et al., 2023).
3. Institutional fragmentation.CE requires cross-sectoral coordination across ministries of environment, industry, trade, and finance. In many developing countries, institutional silos prevent integrated policy-making, leading to fragmented or contradictory initiatives. Weak data systems and limited monitoring capacity exacerbate these challenges (UNECA, 2024; UNCTAD, 2023).
4. Infrastructure deficits.Basic waste management, energy distribution, and transport infrastructure remain inadequate in many contexts. More than 600 million people in Africa still lack access to electricity, complicating efforts to implement renewable energy-based CE models (IEA, 2023). Inadequate recycling and composting infrastructure similarly constrains local enterprises from scaling up.

These constraints highlight that CE cannot be transplanted wholesale into developing contexts. Instead, it requires adaptation to structural realities and deliberate policy support to overcome systemic bottlenecks.

Africa as a case study of CE-driven growth

African experiences illustrate both the promise and the complexity of CE's relationship with economic growth. Several countries have adopted national strategies or roadmaps for CE, often supported by international organizations such as UNEP, UNIDO, and the African Circular Economy Network (ACEN, 2025). These frameworks aim to harness CE for industrial transformation, employment, and environmental sustainability.

- Kenya.Nairobi has emerged as a hub for CE entrepreneurship, particularly in waste recycling and sustainable fashion. Start-ups are developing mobile platforms for peer-to-peer resale and repair, while community organizations run large-scale composting initiatives. These models create jobs for youth and women, while reducing landfill pressure.
- Rwanda.The government has positioned CE as part of its broader Vision 2050 strategy. Rwanda's ban on plastic bags, combined with investments in e-waste recycling and renewable energy, showcases how regulatory frameworks can foster innovation. The Kigali Innovation City also hosts start-ups working on eco-design and upcycling.
- South Africa.National CE initiatives are linked to industrial clusters, particularly in mining regions. Pilot projects integrate CE principles into construction and manufacturing, while also seeking to formalize informal waste-picking networks. These efforts aim to balance industrial competitiveness with social inclusion (Muriithi&Ngare, 2023).

These cases illustrate that CE can contribute to inclusive growth if supported by coherent policy frameworks and targeted investment in SMEs and community initiatives. However, they also underscore that scaling up remains a challenge, particularly in contexts with weak institutional and infrastructural support.

Employment generation is one of the most significant pathways through which CE can stimulate growth in developing countries. Repair, remanufacturing, composting, and recycling are labor-intensive sectors that can absorb large segments of the workforce, particularly youth and women.

The informal economy plays a central role in this process. In many African countries, waste pickers, repair workers, and community cooperatives already engage in circular practices, often outside formal recognition. Their contributions to material recovery and reuse are substantial, but their exclusion from policy frameworks leaves them vulnerable to exploitation and precarity (Muriithi&Ngare, 2023).

Formalizing and integrating the informal sector into CE policies is therefore critical. Doing so not only improves efficiency but also ensures equity, transforming CE from a niche innovation into a broad-based development strategy. This integration could involve providing legal recognition, extending social protection, and facilitating access to finance and training.

CE and inclusive growth in developing contexts

The question of inclusivity lies at the heart of CE's relationship with economic growth in developing countries. If CE models are designed to empower local entrepreneurs, build domestic value chains, and support vulnerable communities, they can deliver "inclusive sustainability." This means creating jobs, reducing ecological pressures, and strengthening resilience while addressing poverty and inequality.

However, if CE adoption is driven primarily by multinational corporations or imposed through external trade standards without local adaptation, it risks reproducing dependency and inequality. In this sense, the African experience serves as both a warning and an inspiration:

CE can either reinforce existing structural vulnerabilities or provide a platform for transformative and inclusive development.

The relationship between CE and growth in developing countries cannot be understood solely in terms of GDP expansion. It must be framed within broader developmental goals that include social equity, environmental resilience, and structural transformation. CE has the potential to become a catalyst for such development, but only if embedded in national strategies that prioritize inclusivity, technological adaptation, and institutional coordination.

As argued in UNIDO (2024), national CE roadmaps are critical for providing regulatory certainty, mobilizing investment, and aligning stakeholders. These roadmaps should not only set environmental targets but also identify pathways for industrial upgrading, employment generation, and social protection. In doing so, they can transform CE from a policy slogan into a concrete driver of development.

For developing countries, the challenge lies in balancing global integration with local adaptation. Aligning with international sustainability standards is necessary for competitiveness, but domestic CE models must be tailored to local socio-economic realities. This dual approach can ensure that CE contributes to inclusive, sustainable, and resilient growth.

Comparative Case Studies and Policy Pathways

National strategies and policy frameworks in Africa

Across Africa, governments and regional institutions have begun to integrate circular economy principles into national development strategies. These initiatives often aim to reduce reliance on resource extraction, stimulate domestic industries, and position African economies within global sustainability frameworks.

Rwanda stands out for its proactive stance. Since banning plastic bags in 2008, Rwanda has expanded CE initiatives into e-waste management and renewable energy. The Kigali Innovation City promotes start-ups focusing on eco-design, sustainable construction, and recycling. These policies not only reduce environmental pressures but also create employment opportunities and attract investment (UNIDO, 2024).

Kenya has developed vibrant entrepreneurial ecosystems around CE. Mobile platforms for peer-to-peer resale, repair services, and waste collection highlight how digital innovation can address both resource efficiency and unemployment. Nairobi's start-up culture demonstrates how CE can thrive in contexts with high youth unemployment and limited formal infrastructure (Muriithi&Ngare, 2023).

South Africa provides another instructive example. CE is linked to industrial clusters, particularly in mining and manufacturing. Pilot projects focus on reusing industrial by-products in construction and energy production. Additionally, initiatives to formalize informal waste-picking networks illustrate how social inclusion can be integrated into CE policies (ACEN, 2025).

These African cases highlight the dual nature of CE transitions: while government frameworks and entrepreneurial innovation are advancing, challenges persist in scaling up due to infrastructural gaps, capital shortages, and institutional fragmentation.

Latin American experiences: Resource efficiency and social innovation

Comparative perspectives from Latin America illustrate both similarities and divergences. In Brazil**,** CE practices have long been embedded in waste management, particularly through the integration of waste pickers (catadores) into municipal recycling systems. Legal frameworks recognize these workers, providing them with cooperative structures and access to social protection. This model demonstrates how integrating the informal sector can deliver both environmental and social benefits, a lesson relevant for African contexts (Schröder et al., 2019).

Colombia has adopted a National Circular Economy Strategy (2018), focusing on sustainable production and consumption, bioeconomy, and water resource management. By linking CE to peacebuilding and rural development, Colombia highlights the potential of CE to address structural inequalities beyond purely environmental objectives.

These Latin American experiences underline the importance of combining CE with social policies, ensuring that marginalized groups benefit directly from sustainability transitions.

Asia: Industrial symbiosis and policy roadmaps

In Asia, CE has often been promoted as part of broader industrial upgrading strategies. China's Circular Economy Promotion Law (2008) and subsequent Five-Year Plans institutionalized CE as a core element of industrial policy. While much of the focus has been top-down, driven by state-owned enterprises, China's experience illustrates the role of strong regulatory frameworks and public investment in scaling CE practices (UNCTAD, 2023).

India presents a more decentralized approach. CE initiatives focus on e-waste management, plastic recycling, and renewable energy. Informal workers play a significant role, particularly in waste collection and repair. However, the absence of consistent national frameworks limits integration, leaving many initiatives fragmented. Nonetheless, India's emphasis on SMEs and start-ups echoes African pathways, particularly in sectors such as sustainable textiles and agricultural innovation.

These Asian experiences highlight the role of state capacity: while China demonstrates how top-down planning can accelerate CE transitions, India underscores the risks of fragmentation without coherent national strategies. Both provide lessons for African countries seeking to balance central coordination with entrepreneurial dynamism.

Policy pathways for developing countries

Comparative evidence suggests several policy pathways that can enhance the effectiveness of CE in fostering inclusive growth across developing regions:

1. National CE Roadmaps.As emphasized by UNIDO (2024), coherent national strategies provide regulatory certainty, align ministries, and attract investment. Countries such as Rwanda and Colombia demonstrate how roadmaps can link CE to broader development goals, from industrial upgrading to rural employment.
2. Integration of the Informal Sector.Both Latin American and African experiences underline the necessity of recognizing informal workers. Brazil's cooperative model for waste pickers and South Africa's pilot projects for waste integration offer replicable frameworks for inclusive sustainability.
3. SME and Entrepreneurial Support.Access to finance, training, and incubation programs is essential. Kenya's start-up ecosystem illustrates how entrepreneurial energy can drive

CE innovation, but scaling requires targeted financial instruments such as microcredit, blended finance, and green bonds (UNECA, 2024).

4. Technological Adaptation and Digital Innovation.Leapfrogging opportunities in digital platforms, mobile payments, and blockchain-based traceability systems allow developing countries to bypass expensive traditional infrastructure. However, ensuring inclusivity requires extending these technologies beyond urban elites.
5. Regional Cooperation.CE benefits from economies of scale, particularly in waste management and renewable energy. Regional initiatives in Africa, such as the African Circular Economy Alliance, provide platforms for knowledge sharing, capacity building, and investment mobilization (ACEN, 2025).
6. Social Equity and Just Transition.CE policies must address distributional issues to avoid reinforcing inequalities. This requires labor protections, gender-sensitive policies, and explicit measures to support vulnerable communities. The concept of "inclusive sustainability" is particularly relevant for Africa, where high youth unemployment and rural poverty remain pressing challenges (Marinov, 2025a).

The comparative analysis underscores that while CE offers a common framework for sustainable growth, its implementation is deeply context-dependent. African countries can learn from Latin America's emphasis on social inclusion, Asia's experience with industrial policies, and their own grassroots innovations. However, these lessons must be adapted to structural realities such as limited infrastructure, capital constraints, and institutional fragmentation.

Ultimately, CE should not be viewed as a one-size-fits-all model but as a flexible framework that can be localized. For Africa and other developing regions, the key lies in embedding CE within broader national development strategies, ensuring that transitions are not only environmentally sustainable but also socially equitable and economically transformative.

Conclusions

Circular economy has emerged as a transformative paradigm for reconciling economic growth with sustainability, particularly in developing countries where socio-economic challenges and environmental vulnerabilities are deeply intertwined. As shown throughout this article, CE is not merely a technical approach to waste management but a holistic framework capable of restructuring production, consumption, and trade systems. Its potential lies in enabling countries to leapfrog traditional development trajectories, foster industrial transformation, and create inclusive employment opportunities.

From a theoretical perspective, CE addresses the long-standing debate on whether economic growth can be decoupled from resource consumption. Traditional linear models of development – based on extraction, production, consumption, and disposal – are increasingly untenable under the pressures of climate change and resource scarcity. CE offers an alternative by closing material loops, promoting reuse and recycling, and extending product lifecycles. For developing countries, this model is particularly appealing as it promises not only environmental benefits but also industrial diversification, innovation, and resilience against external shocks.

Yet, as critics warn, the CE transition is not inherently inclusive. Without deliberate policies, CE may reinforce existing inequalities, marginalize informal actors, or concentrate benefits in high-value sectors controlled by multinational corporations. This raises the crucial question of what kind of growth CE promotes: inclusive and sustainable, or exclusive and extractive.

Africa illustrates both the opportunities and constraints of CE in developing contexts. Case studies from Rwanda, Kenya, and South Africa demonstrate how CE can be integrated into national policies, entrepreneurial ecosystems, and community practices. Rwanda's ban on plastics, Kenya's digital start-up ecosystem, and South Africa's industrial symbiosis projects highlight the continent's capacity for innovation and policy leadership. These examples confirm that CE can create jobs, attract investment, and reduce environmental pressures when embedded in coherent strategies.

However, persistent challenges remain. Weak infrastructure, limited access to finance, and institutional fragmentation hinder the scaling of CE practices. More than 600 million Africans still lack access to electricity, illustrating the tension between CE's sustainability ambitions and basic developmental needs. Moreover, the informal sector – which plays a central role in recycling, repair, and waste collection – remains excluded from formal CE policies, despite its importance for both efficiency and equity. Interviews with practitioners reinforce this gap, underscoring the need for recognition, protection, and integration of informal workers into national strategies.

Comparative perspectives from Latin America and Asia provide valuable lessons. Brazil's integration of waste pickers into municipal recycling illustrates the benefits of aligning CE with social inclusion. Colombia's national strategy demonstrates how CE can support rural development and peacebuilding, while China's top-down regulatory frameworks reveal the role of strong state capacity in scaling CE initiatives. India's fragmented yet entrepreneurial approach highlights both the potential and the risks of relying heavily on SMEs without coherent national coordination.

For Africa, these cases underscore the importance of combining entrepreneurial dynamism with institutional frameworks. Latin America demonstrates the necessity of embedding CE in social policies, Asia highlights the role of regulatory capacity, and African innovations reveal the power of grassroots entrepreneurship. Together, these lessons suggest that CE must be context-specific, tailored to national capacities, and linked to broader development priorities.

The analysis points to several policy imperatives for developing countries:

1. Develop coherent national CE roadmaps to provide regulatory clarity, align ministries, and signal long-term commitment to investors.
2. Integrate the informal sector – recognizing waste pickers, repair workers, and cooperatives ensures both efficiency and equity.
3. Strengthen access to tailoredfinance instruments such as microcredit, blended finance, and green bonds are necessary to support SMEs and start-ups.
4. Leverage digital innovation through mobile platforms, blockchain traceability, and decentralized energy systems that offer opportunities to bypass infrastructural deficits.
5. Linking CE to industrial policy, climate adaptation, and rural development ensures coherence and maximizes synergies.
6. CE strategies must address gender, youth, and rural inclusion to avoid exacerbating inequalities.

Ultimately, CE in the context of developing countries must be understood not only as an environmental or economic strategy but as a pathway to "inclusive sustainability." This concept emphasizes that transitions must create jobs, strengthen local value chains, and address the needs of vulnerable communities, while simultaneously reducing environmental pressures. Africa's experiences show that such integration is possible but requires deliberate policy design, targeted financial mechanisms, and regional cooperation.

The broader implication is that CE is not a one-size-fits-all model but a flexible framework adaptable to diverse contexts. By embedding CE into national development strategies and

empowering local actors, developing countries can turn structural weaknesses into competitive advantages. In doing so, they can chart a path toward economic growth that is not only greener but also fairer, more resilient, and better aligned with the global pursuit of sustainability.

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VULNERABILITIES IN ECONOMY ARISING FROM DEFICIENCIES IN PUBLIC PROCUREMENT

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"If someone tells you that you can rise by any means other than culture, hard work, and economic endeavor, avoid them"

Benjamin Franklin (1707 – 1790, writer, scientist, inventor, statesman, diplomat, printer, publisher, and political philosopher.)

Abstract:

Economy benefits from a powerful instrument for growth and development, namely public procurement; it can generate solutions to social and environmental challenges and contribute to the advancement of innovation. Public procurement plays a crucial role for both the public sector and the private sector, as its specific processes involve expenditures on goods, services, and works, enable investments, fostering employment. Integrity in public procurement is essential to fully benefit from the processes taking place within the economy. Otherwise, when public procurement is not conducted in compliance with legal procedures, lacking economic and social efficiency, and sound financial management, it generates vulnerabilities in economy. In practice, the primary objective is to assess whether effectiveness, and economy ('value for money') are achieved under conditions of integrity and accountability.The objective of this study is to assess the scope and scale of deficiencies and to focus on their reduction. The consequences of the identified deficiencies are reflected in the substantial extent of losses, additional revenues, and financial-accounting irregularities. The conclusion is that strengthening oversight in the field of public procurement in Romania can lead to a reduction of deficiencies in this area.

Keywords: *fraud*, *corruption, public procurement*

JEL classification: D73, H11, H57

Introduction

Public procurement is a means through which the state and the economy can contribute to economic progress and development, to rising the the standard of living of its citizens, and to

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improving the quality of life. For these outcomes to be achievable, efforts at the political, economic, and legislative levels must be consistent and oriented toward the main objective of prosperity.

It can be argued that solutions to economic problems cannot be found unless inefficiencies in the public system are analysed and addressed. Those deficiencies associated with public procurement are among these inefficiencies.

The deficiencies we refer to may include the failure to adhere to principles such as economic and social efficiency, particularly sound financial management. Sound financial managementmeans ensuring legality, regularity, cost-efficiency, and effectiveness in the use of public funds and in the administration of public assets.

In terms of ensuring the efficiency of fund utilization, this involves awarding procurement contracts on a competitive basis and using award criteria that reflect the economic advantages of bids, in order to achieve an optimal balance between quality and price, including by taking into account social, ethical, and environmental objectives.

Failure to comply with legal provisions, as well as with principles underlying the award of public procurement contracts, such as non-discrimination, equal treatment, mutual recognition, transparency, proportionality, and accountability, affects economy.

Vulnerabilities in public procurement are those that can affect the core components of the Romanian economy. The components that may be impacted include, on the one hand, freedom of trade, protection of fair competition, and creation of a favourable framework for the utilization of all production factors. Another aspect of the economy affected by these vulnerabilities concerns the safeguarding of national interests in economic, financial, and monetary activities.Furthermore, due to the aforementioned vulnerabilities, the stimulation of national scientific and technological research, the arts, and the protection of intellectual property rights is negatively affected. Another area influenced by vulnerabilities in public procurement includes the exploitation of natural resources in accordance with national interests. Additionally, certain dimensions of the economy are easily impacted by deficiencies and irregularities in public procurement that relate to environmental restoration and protection, as well as the maintenance of ecological balance. Moreover, public procurement weaknesses often hinder the establishment of conditions necessary for improving the quality of life. Fraud and corruption in public procurement adversely affect the implementation of regional development policies in line with the objectives of the European Union.

Deficiencies in public procurement, specifically deviations from legality, regularity, economy, effectiveness, and efficiency in the use of public funds and the management of public assets, contribute to the amplification of fraud and corruption in public procurement in Romania.

To ensure coherence in addressing vulnerabilities, it is necessary to act in key areas, such as improving the quality of the legislative framework, including the assessment of options for transposing new European regulations into national legislation. Another area of action concerns the overall coherence and efficiency of the national institutional system involved in public procurement. A particularly important component requiring attention is ensuring the regularity and quality of the public procurement process. Strengthening the capacity of contracting authorities, especially with regard to professionalization and integrity assurance plays a major role in guaranteeing the integrity of public procurement in Romania. The public procurement system in Romania must be reinforced to enhance its monitoring and supervisory functions.The objective of this study is to assess the scope and scale of deficiencies and to focus on their reduction. The consequences of the identified deficiencies

are reflected in the substantial extent of losses, additional revenues, and financial-accounting irregularities.

Literature Review

Publicprocurement is the process through which state authorities, at the central or local level, referred to as contracting authorities, purchase goods, works, or services to meet public needs, required to support the public functions of the state. Public procurement is crucial for ensuring economic growth and developing the state's capacity to respond to citizens' needs and improve their standard of living. The manner in which the state conducts public procurement reflects the efficiency of public fund management and the administration of public assets. When discussing public procurement, one must consider the specific process that includes planning and organizing procurement, conducting the necessary publicity, applying the relevant procurement procedures, and awarding and managing public procurement contracts. The three main areas of public procurement are goods, works, and services. Market transactions involving goods, works, and services are important both for Romania and for Europe. When carried out properly, such market transactions contribute to prosperity, and development; they foster innovation and technical progress, enhancing competitiveness and productivity, and benefitting everyone.

Vulnerabilities in economy arise from failures in economic and social efficiency and from shortcomings in sound financial management, which must be based on legality, regularity, cost-effectiveness, and efficiency in the use of public funds and the management of public assets.

Public procurement also plays a highly significant role in Europe, where major efforts are focused on identifying strengths and weaknesses in order to support a forward-looking strategy aimed at reducing deficiencies to the greatest extent possible, enhancing competitive advantages, and identifying and developing new opportunities. It should be emphasized that at the European level, concerns about competing and advancing within the global economy remain highly relevant, particularly in the current geopolitical context. It is worth noting that the European Union's long-term competitiveness is founded on the single market, which encompasses nearly 450 million people, 23 million enterprises, and a GDP of €17 trillion [1].

These facts and figures place the EU among the world's three largest economies, accounting for roughly one-sixth of the global economy. It should be noted that there is a number of long-standing barriers within the single market; the administrative issues prevent the European economy from reaching its full potential. With regard to the integration of the single market, progress has slowed, and barriers, particularly in the area of services, remain in place. Enterprises, especially SMEs, face difficulties, particularly in the state administrative and legislative areas, as they struggle to comply with legal provisions that are often unpredictable, adopted in haste, and frequently enacted without consultation with the business community. Such a hostile environment hampers the conduct of economic activities and reduces opportunities for enterprises to grow. Thus, within the EU, economic competitiveness is increasingly subject to growing pressures from multiple perspectives. One such perspective concerns structurally rising prices, primarily in energy and particularly in electricity. As of 2025, electricity prices are two to three times higher compared to the United States [2]. Among the causes that have generated this situation are the decline in business investment, resulting from the reduced commercialization of research outcomes, itself a consequence of decreased public and private investment in specific technologies and sectors. As a result, the expansion and adoption of new digital technologies, as well as other emerging technologies, are stagnating or experiencing delays compared to competing

economies. At the same time, the supply of specialized labor remains insufficient. The geopolitical context characterized by turbulence and instability calls for greater attention to the strategic dependencies of both individual states and Europe. Economic vulnerabilities, particularly deficiencies in public procurement, undermine investment capacity and weaken economic competitiveness.

Consolidating public procurement within a procurement entity for centralized purchases can help enhance economic and social efficiency [3].

It should be noted that even centralized systems may have certain limitations, particularly regarding the rigidity of technical specifications [4].

Aggregating public procurement on behalf of multiple contracting authorities can ensure better governance [5]. Another drawback is the reduced ability to identify the specific needs of the contracting authority [6]. Another negative aspect is that the centralization of public procurement can create market distortions, concentrating power among large economic operators and excluding small and medium-sized enterprises [7].

A real issue may arise in centralized procurement concerning the operationalization of the delivery process, as bureaucratic distance can create discrepancies between the procured goods and the operational realities of the contracting authorities [8].

At the same time, it can ensure greater compliance with regulations, enhance the capacity to negotiate better prices, and improve efficiency [9]. At the same time, there are risks of inefficiency, fragmented requirements, and fraud and corruption, particularly in countries with weak administrative capacity [10].

In Romania, public procurementis an essential pillar of the economy directly impacting infrastructure development, public services, and the efficient use of national and European public funds.

Methodology and Data

The evolution of gross domestic product, total expenditures, and public procurement spending between 2016 and 2024 shows that Romania’s economy has followed an upward trend, and public procurement has expanded, highlighting the need for increased attention to how these procurements are carried out.

Between 2016 and 2024, a series of indicators such as gross domestic product (GDP), total expenditures (TE), and public procurement expenditures (PPE)consistently recorded increases, according to data provided by the Ministry of Finance. Their evolution, evaluated in Euro at the end of each year using the official leu/euro exchange rate published by the National Bank of Romania, is presented below.

The evolution of certain indicators between 2016 and 2024, evaluated in Euro at the end of each year, such as gross domestic product (GDP), total expenditures (TE), and public procurement expenditures (PPE), is presented in Table 1 below:

Table 1: Evolution of GDP, TE, and PPE (thousand euros), between 2016 and 2024, Romania

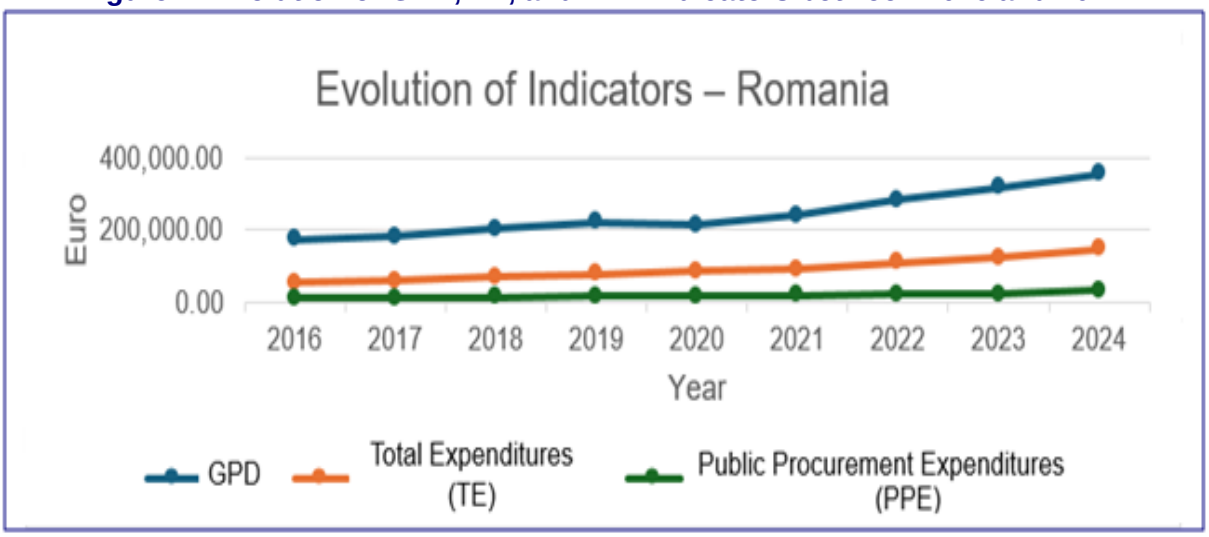
Euro	2016	2017	2018	2019	2020	2021	2022	2023	2024
GDP	172,975.71	180,805.63	204,206.14	221,748.58	213,742.97	239,971.30	283,248.78	318,317.05	354,737.54
Total Expenditures (TE)	53,294.58	59,248.45	69,065.59	77,339.57	87,163.72	92,890.81	109,343.90	122,894.30	146,220.62
Public Procurement Expenditures (PPE)	13,204.95	12,914.99	14,622.31	17,487.92	18,535.14	19,781.13	22,844.73	23,313.63	31,936.03

Source: Romania, Ministry of Finance; author's own assessments and calculations

The graphical representation of the evolution of GDP, TE, and PPE between 2016 and 2024 mainly shows an increase in all three indicators, as illustrated in Figure 1 below:

The graph showing the evolution of GDP, TE, and PPE from 2016 to 2024 highlights a general increase in all three indicators, as shown in Figure 1 below:

Figure 1: Evolution of GDP, TE, and PPE indicators between 2016 and 2024



Source: Romania, Ministry of Finance; author's own estimates and calculations

Results

Under the generally upward trend of GDP, TC, and PPE between 2016 and 2024, the deficiencies recorded between 2017 and 2024 in the field of public procurement generated consequences reflected in certain specific indicators, namely damages, additional revenues, and financial-accounting irregularities. These were determined on the basis of the author's personal assessments and calculations, expressed in Euro, and exhibited fluctuating developments, as illustrated in Table 2, as follows:

Table 2: Evolution of specific indicators, in thousand euros, between 2017 and 2024, Romania

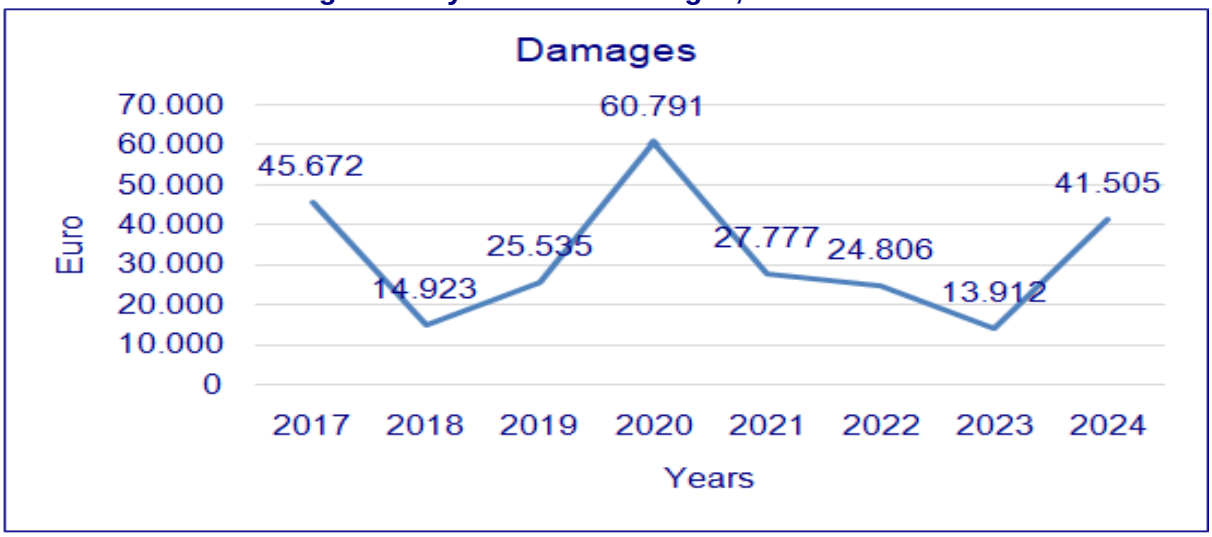
Indicator	2017	2018	2019	2020	2021	2022	2023	2024
Damages	45.672	14.923	25.535	60.791	27.777	24.806	13.912	41.505
Additional revenues	955	299	284	4.096	379	487	60	1
Financial-accounting irregularities	354.483	7.904	20.288	425.160	24.174	17.525	304.061	245.166

Source: Romania, specialized reports, and the author's own assessments and calculations

In the case of deficiencies in the field of public procurement between 2017 and 2024, and of their aggregate consequences reflected in the specific indicator *damages*, according to the above-mentioned data and information, the evolution was fluctuating, reaching its lowest level in 2023 and peaking in 2020.

The evolution of the consequences materialized as damages incurred either by the state budget, or local budgets, or the budgets of contracting entities, evaluated in thousand euros, in Romania, between 2017 and 2024, can be observed graphically in Figure 2 below:

Figure 2: Dynamics of damages, 2017–2024



Source: Romania, specialized reports, and the author's own assessments and calculations, thousand euros

In the case of deficiencies in the field of public procurement between 2017and 2024, and of their aggregate consequences reflected in the specific indicator additional revenues, according to the above-mentioned data and information, the evolution was fluctuating, reaching its lowest level in 2024 and peaking in 2020.

The evolution of the consequences materialized as additional revenues lost by the state budget, local budgets, or the budgets of contracting entities, evaluated in thousand euros, in Romania between 2017and 2024, can be observed graphically in Figure 3 below:

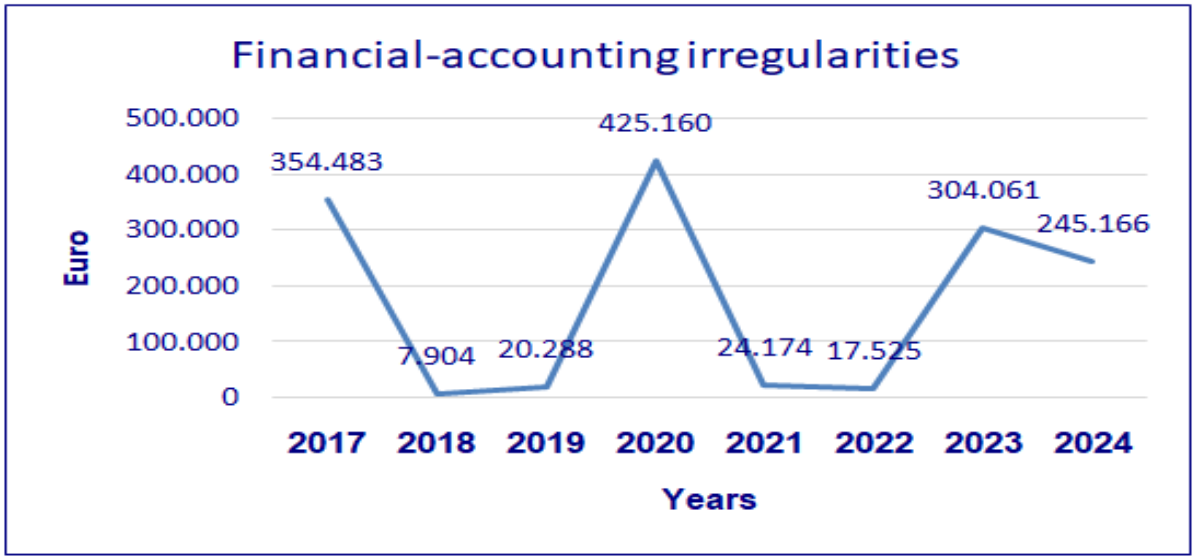
Figure 3: Dynamics of additional revenues, 2017–2024

Source: Romania, specialized reports, and the author's own assessments and calculations, thousand euros

In the case of deficiencies in the field of public procurement between 2017 and 2024, and of their aggregate consequences reflected in the specific indicator financial-accounting irregularities, according to the above-mentioned data and information, the evolution was fluctuating, reaching its lowest level in 2023 and peaking in 2020.

The evolution of consequences materialized as financial-accounting irregularities, namely errors in procurement documentation, recording mistakes, or incorrect registration of specific transactions in the financial-accounting records of authorities or contracting entities, evaluated in thousand euros, in Romania, between 2017 and 2024, can be observed graphically in Figure 4 below:

Figure 4: Dynamics of financial-accounting irregularities between 2017 and 2024



Source: Romania, specialized reports, and the author's own assessments and calculations, thousand euros

The sector most affected by deficiencies in public procurement in 2024, in terms of aggregate consequences reflected in the specific indicator damages, was local public administration, accounting for approximately 95% of the total identified damages.

Thus, regarding the value of damages recorded in 2024, there is an upward trend compared to the periods 2018–2019 and 2021–2023, and a decrease compared to 2017 and 2020.

In certain sectors of activity, an increase in the value of consequences resulting from deficiencies or legal irregularities found in 2024, aggregated in the specific indicator damages, was recorded compared to previous periods. These sectors are as follows:

- Local public administration (€39,496.39 thousand in 2024, compared to €11,340.81 thousand in 2023, €23,109.11 thousand in 2022, €22,475.50 thousand in 2021, €18,495.50 thousand in 2020, €16,195.26 thousand in 2019, €12,126.55 thousand in 2018, and €33,454.51 thousand in 2017).

- Culture, national education, scientific research, youth and sports (€679.92 thousand in 2024, compared to €647.29 thousand in 2023, €485.31 thousand in 2022, €102.46 thousand in 2021, €14.99 thousand in 2020, €236.65 thousand in 2019, €84.91 thousand in 2018, and €107.09 thousand in 2017).

The most frequent types of deficiencies in 2024, which increased compared to the period 2017–2023, grouped by the three stages of the public procurement process, without being limited to these, are as follows:

● In the *planning/preparation stage of the public procurement procedure:*

- Inclusion in the purchase requisition of goods, services, and/or works unrelated to the entity's field of activity and/or whose acquisition is prohibited, which were nevertheless procured and paid for;

- Inclusion in the investment program, annexed to the budget of revenues and expenditures, of new and/or ongoing investment objectives whose technical-economic documentation or approvals for intervention works are not legally authorized;

- Errors in applying the rules for estimating the value of procurements;

- Incorrect selection of the procedure for awarding the public procurement contract;

- Splitting into multiple smaller contracts or using calculation methods that lead to underestimation of the estimated value, with the purpose of remaining below the legally established thresholds and avoiding compliance with the legal contract award procedures;

- The annual public procurement strategy and/or the annual public procurement plan were not prepared / updated on time or in the legally required format;

- Failure to publish, within the legal deadlines, in the Electronic Public Procurement System, the extracts from the annual procurement plan relating to contracts/framework agreements for goods, services, and works whose estimated value is equal to or above the regulated thresholds;

- Non-compliance with the principle of sound financial management in the preparation and approval of the annual public procurement strategy, including the annual public procurement plan.

● In *the organization stage of the public procurement process:*

- Direct procurement was not carried out solely in cases permitted by law;

- Failure to transmit a notification in the Electronic Public Procurement System within the legal deadline for direct procurements;

- Failure to submit the draft legal commitment for review by the internal financial control authority;

- Commitment of expenditures through the conclusion of procurement contracts for which funding sources were not approved in the budget;

- Commitment of expenditures through the conclusion of procurement contracts with economic operators lacking the required legal authorizations;

- Non-compliance with the principles underlying the award of public procurement contracts;

- Non-compliance with legal provisions regarding the publication of award notices and any other documents required by law in the Electronic Public Procurement System and/or the Official Journal of the EU;

- Failure to meet the deadlines specified in the public procurement documentation;

- The concluded contract does not correspond to the technical and financial proposal of the declared winning bid and to other procurement documents;

- the award of the winning bid was carried out based on the award criteria and evaluation factors specified in the invitation to participate/notice to participate and in the procurement documents without cumulatively meeting the required conditions.

● In the *post-award stage (execution and monitoring of the implementation) of the contract/framework agreement:*

- Payment for goods not delivered / works not executed / services not provided, which are not advances stipulated in the public procurement contracts;

- Failure to establish the performance guarantee in the legally required amount / failure to record it in the accounting system;

- Lack of documents certifying the receipt of delivered goods / execution of works, or confirmation of services provided under the public procurement contract;

- Work reports including expenses and/or quantities of materials and/or equipment / unit prices / rates, etc., different from those offered;

- Making payments from budgetary credits approved for other purposes;

- Non-compliance with contractual clauses regarding the quantity and quality of goods delivered / works executed / services provided, or with the established deadlines;

- Adjustment of the contract price in violation of legal and/or contractual provisions.

The most important causes of deficiencies in the field of public procurement can be identified as follows:

- The increasing volume and complexity of national public procurement legislation, without adequate monitoring of the legislative process;

- Largely unsatisfactory methodological coordination by authorized institutions, and the maintenance of ex-ante and ex-post control mechanisms exercised by institutions that either lack competence under specific regulations, or do not apply a unified approach, or are staffed by personnel with differing training and experience in public procurement;

- Divergent approaches to similar causes or cases in public procurement administrative and jurisdictional settlement;

- Lack of an adequate integrated information system containing complete data necessary for stakeholders to carry out various evaluations from the initiation to the completion of the public procurement process;

- Insufficient training of personnel with responsibilities in public procurement.

Conclusions

The analysis of the causes and circumstances leading to the occurrence and recording of deficiencies or legal irregularities identified by control authorities in 2024, compared to those identified between 2017 and 2023, indicate that these remain at a high level.

The main cause of deficiencies in public procurement is the non-compliance with applicable regulations by those responsible for procurement, particularly regarding the principles underlying the award of public procurement contracts. These principles include non-discrimination, equal treatment, mutual recognition, transparency, proportionality, and accountability, as well as sound financial management in the use of public funds and administration of public assets, which have a direct impact on the economy.

Additionally, contributing factors include the complex and extensive legislation, lack of methodological guidance, personnel shortages, and insufficient qualification in public procurement within public institutions and authorities.

Furthermore, practice has revealed poor communication both between internal departments involved in the public procurement process and among decision-makers and operational staff, as well as incorrect knowledge and enforcement of laws and other applicable regulations in the field of public procurement.

Another issue concerns the lack of internal procedures for carrying out and monitoring procurements at the level of the public institution / authority, as well as inadequate oversight of the execution of public procurement contracts.

National legislation creates confusion among those required to apply it, including contracting authorities and economic operators alike, discouraging participation from the latter in procedures, with consequences such as reduced competition, failure to achieve the best value-for-money, and ineffective use of public funds.

The following recommendations should be considered for eliminating deficiencies in public procurement, including, but not limited to:

- Ensuring compliance with the principles underlying the award of public procurement contracts (non-discrimination, equal treatment, mutual recognition, transparency, proportionality, and accountability);

- Ensuring compliance with legal provisions requiring the organization of competitive award procedures in accordance with the monetary thresholds established by law;

- Compliance with the obligation to use electronic means for the application of award procedures and for direct procurement;

- Ensuring compliance with legal provisions regarding the preparation of award documentation, including the detailed specification of evaluation factors and scoring

algorithms, in order to determine the most economically advantageous offer in accordance with the law;

- Determining the extent of identified damages, taking all necessary legal measures for their recovery, including applicable interest and penalties for delay, recording recovered amounts in accounting, and remitting them in accordance with the law;

- Extending verifications to all public procurement contracts concluded and payments made under them, in order to identify potential deficiencies, determine the extent of possible damages, and recover them.

The conclusion is that strengthening oversight in the field of public procurement in Romania can lead to a reduction of deficiencies in this area.

In conclusion, it is necessary to simplify the specific legislation in the field of public procurement, altogether with intensified methodological guidance, and, above all, to strengthen and enhance the continuous training of specialized personnel in this field, while ensuring legality and increasing the transparency of public procurement processes.

Acknowledgments

Information and data from the statistics of the Romanian Ministry of Public Finance, from verification activities, the development of specific methodologies, and professional training in the field of public procurement of certain control bodies, as well as the author's own assessments and calculations, were used.

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PUBLIC PROCUREMENT REFORM AS A DRIVER OF FINANCIAL SUSTAINABILITY AND INCLUSIVE ECONOMIC DEVELOPMENT

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Abstract:

This study addresses the impact of public procurement reform on the economy and financial sustainability, focusing on the integration of inclusive development principles. The main objective of the research is to analyze how new regulations can support the efficient allocation of public resources, while promoting social inclusion and equitable development.
The specific objectives include: identifying current procurement practices that limit the potential for sustainability and inclusion; proposing a reform framework based on sustainable criteria, such as social and environmental impact; assessing the potential impact of these reforms on economic growth and social justice.
The methodology used combines a detailed bibliographic analysis of national and international regulations, together with relevant case studies in the field of public procurement. Secondary data and qualitative analyses are also used to assess the impact and efficiency of various reform models implemented in this sector.
The anticipated results indicate that a well-structured public procurement reform can generate multidimensional benefits. These reforms are expected to lead to a more efficient allocation of public funds, stimulate innovation in the public sector, and thus contribute to more inclusive and sustainable economic development.

Keywords: *financial sustainability, sustainable public procurement, circular economy.*

JEL classification: *D 73, H 57, O 23.*

Introduction

In recent decades, the field of public procurement has gained strategic importance within public administration, constituting an essential factor in increasing the efficiency of government spending, in strengthening administrative transparency and in supporting economic development. Reforming the public procurement system represents a fundamental instrument for achieving the objectives related to budgetary sustainability and promoting inclusive economic development, all the more relevant in the current context, marked by

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multiple economic and social challenges. The management of a significant proportion of public financial resources through this mechanism gives the procurement process a direct impact on the quality of public services and on the level of economic development, both at local and regional scales, and at national level.

In this context, the main objective of public procurement reform is to maximize the use of financial resources, while ensuring that they are directed towards sectors and projects that contribute to sustainable and equitable economic development. Public procurement reform involves not only updating the legislative and institutional framework, but also a paradigm shift, which aims to integrate social, environmental and economic objectives throughout the procurement cycle – from planning and assessment, to implementation and monitoring. Thus, public procurement becomes a lever through which states can stimulate innovation, support small and medium-sized enterprises, promote social inclusion and contribute to the transition to a green and resilient economy.

Literature Review

Public procurement has experienced continuous development throughout history. From its origins to the present day, public procurement has taken various forms, but the purpose and importance have remained the same – to capitalize on the public interest for the proper functioning of public services. [1]

The specialized literature dedicated to public procurement has developed significantly in recent decades, as the role of this field has gone beyond the strictly administrative sphere and has been increasingly approached from the perspective of public policies, governance and sustainable development. The expenditures made by the public sector through procurement represent a significant share of the gross domestic product of states, which gives these processes a special strategic potential in shaping economic and social development.

Initially, research in the field focused mainly on legal compliance, procedural efficiency and corruption prevention. Authors such as Arrowsmith (2010), Thai (2001) or McCrudden (2004) have substantiated the classical dimensions of public procurement, emphasizing the need for a clear regulatory framework, transparency and fair competition. [2]

Subsequently, the specialized literature began to give increasing importance to strategic public procurement, understood as those purchases that do not only aim to obtain the lowest price, but also to generate social, economic and environmental benefits. The concept of sustainable public procurement was first promoted in the Brundtland Report of 1987, by highlighting the three fundamental dimensions of sustainable development – environment, economy and society – which are, moreover, the basis of the 2030 Agenda and the 17 Sustainable Development Goals. [3]

The European Commission has defined the role of sustainable public procurement as one of the market-based instruments for achieving smart, sustainable and inclusive growth, while ensuring the most efficient use of public funds. [4]

The concept of sustainable public procurement has experienced significant development with the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro from 3 to 14 June 1992. This conference, recognized as one of the most important high-level international events of the 20th century, had as its main objective the identification of alternative solutions for directing global development in the 21st century, in the context of

worsening ecological crises, climate change and increasing socio-economic tensions worldwide.

Studies by OECD (2020), UNDP (2019) and World Bank (2022) highlight the positive impact of sustainable procurement on reducing inequalities, stimulating SMEs, promoting innovation and reducing the ecological footprint. However, the literature also highlights the difficulties related to implementation: lack of institutional capacity, absence of clear sustainability assessment criteria and resistance to change of the actors involved. [5]

Another relatively recent direction in research is the correlation between public procurement and financial sustainability. The author Bovis C. in his paper “The challenges of public procurement reform in the single market of the European Union”, argues that efficient public procurement contributes to long-term budgetary stability by preventing waste, increasing contractual performance and reducing transaction costs. In this sense, public procurement reform is seen not only as an administrative measure, but as a component of sound fiscal governance. [6]

Although the literature in the field is vast, certain gaps persist that justify deepening the topic of this research. Few works deal in an integrated way with the link between public procurement reform, financial sustainability and inclusive economic development. Many of the existing studies focus on the legal or technical analysis of procurement, without integrating economic and social perspectives into a coherent analytical framework.

The European Union's regulatory framework in the field of public procurement is regulated by „Directive 2014/24/EU” [7], which establishes general rules applicable to public procurement, and ”Directive 2014/25/EU” [8], which covers specific procedures for entities operating in sectors of strategic interest, such as water, energy, transport and postal services. The European directives aim to ensure the uniform application of a common regulatory framework for the award of public procurement contracts. By implementing these regulations, the functioning of the internal market is strengthened and competition in public procurement is stimulated at the European Union level.

Therefore, this research aims to contribute to the specialized literature through a systemic approach, focused on the transformative potential of public procurement reform in the context of the new demands of sustainability and economic inclusion.

Methodology and Data

The results presented in this article were obtained by applying a mixed methodology. The research was based on research methods such as comparative analysis, study and evaluation of phenomena, approached from the perspective of the application of national and international legislation

The research analyzed relevant practices at international and national levels regarding the public procurement system, by studying legislation, international standards, as well as regulations, guides and manuals developed in accordance with them.

The study was based on the use of the dialectical method of knowledge, complemented by classical methods such as observation, analysis, synthesis, comparison, induction and deduction.

These methodological tools allowed for an in-depth investigation of the reform of the sustainable public procurement system, seen as an essential factor in promoting financial sustainability and equitable and inclusive economic development.

Results

Sustainable public procurement is a mechanism through which contracting authorities can actively contribute to facilitating the transition to a circular economic model. It plays a key role in stimulating demand and creating market opportunities for economic operators involved in the circular economy.

Sustainable public procurement has evolved significantly in recent decades and has become an essential component of national and international strategies for sustainable development, facilitating the overall achievement of the set of Sustainable Development Goals (SDGs) of the UN 2030 Agenda for Sustainable Development and primarily for achieving SDG 12 - Ensuring sustainable production and consumption patterns, and the sustainable public procurement target 12.7 "Promoting sustainable public procurement practices, in accordance with national policies and priorities". [9]

Public procurement is a strategic tool that can stimulate demand for sustainable products, services and works, thus contributing to the development of green markets. Through this mechanism, the public sector has the ability to positively influence the behavior of private actors, directing them towards environmentally friendly solutions. The main purpose of sustainable public procurement is to reduce the negative environmental impact of goods, services and works purchased by public authorities.

According to the Organization for Economic Cooperation and Development (OECD), sustainable procurement has the potential to stimulate innovation, providing industry with significant impetus for the development of green solutions [10]. The implementation of these practices can also lead to financial savings for the public sector, especially if the cost assessment is carried out over the entire life cycle of products, and not exclusively based on the initial purchase price.

The OECD also highlights that authorities that adopt sustainable procurement policies are better equipped to respond to emerging environmental challenges, such as reducing greenhouse gas emissions or the transition to a circular economy. From an environmental perspective, these procurements aim to optimize the consumption of resources, such as energy and water, reduce the volume of waste generated, as well as adapt to the effects of climate change.

In this context, the traditional paradigm focused exclusively on the lowest price criterion is being overcome in favor of an integrated approach that aims to maximize long-term value and generate a positive impact on society.
Following the analysis of international practice, a significant increase in interest in the use of performance indicators (KPIs) is noted, which allow the evaluation of the efficiency of procurement processes and their contribution to achieving the objectives of social inclusion, environmental protection and economic stimulation.
This paradigm shift reflects an increasingly profound understanding of the fact that public procurement can represent a strategic governance instrument, capable of directly contributing to the establishment of a circular and sustainable economy.
The analysis of the specialized literature allowed the formulation of a tripartite model of public procurement reform, structured around three fundamental, complementary and interdependent dimensions:

- Financial sustainability;
- Economic performance;
- Social impact.

These dimensions reflect the main directions of action identified in the development of a sustainable public procurement system, both at national and international level.

Financial sustainability highlights the need for prudent and efficient management of public financial resources, in order to maintain budgetary balance and prevent waste. Reform in this direction aims to strengthen financial discipline, optimize spending, increase transparency and ensures the long-term viability of the procurement system.

Economic performance aims at the operational efficiency of procurement processes and their capacity to generate added economic value. This dimension involves increasing innovation, digitizing procedures, reducing bureaucracy and stimulating competition. Economic performance reflects the strategic role of public procurement in economic growth and market development.

Social impact represents the integration of social objectives into public procurement strategies and policies. This includes promoting social equity, ensuring ergonomic working conditions and encouraging the inclusion of vulnerable groups. Reforms oriented towards social impact contribute to strengthening social cohesion and sustainable development.

Public procurement accounts for between 15% and 20% of global gross domestic product, and the total value of related contracts amounts to approximately 1.3 trillion euros.

This significant economic force can play an essential role in stimulating investment and technological progress oriented towards sustainable production and consumption practices.

Thus, based on the research carried out, an integrated model of reform of the public procurement system is proposed, designed to ensure an optimal balance between the above-mentioned dimensions.

The proposed model includes the following strategic pillars:

Strengthening the legal and institutional framework for sustainable procurement requires the development of clear and binding regulations that integrate economic, social and environmental sustainability criteria at all stages of the public procurement process. It is also essential to strengthen the capacity of institutions responsible for monitoring and evaluating the implementation of these reforms in order to ensure effective implementation. At the same time, simplifying and standardizing procedures can contribute to increasing transparency and significantly reducing the risks associated with corruption.

Digitalization and increasing transparency in the public procurement process are essential factors for increasing efficiency and accountability. In this regard, the development of modern electronic platforms can facilitate fair and open access to relevant information for all stakeholders. At the same time, the integration of advanced digital solutions allows for real-time monitoring of the development of contracts and their impact on public budget spending.

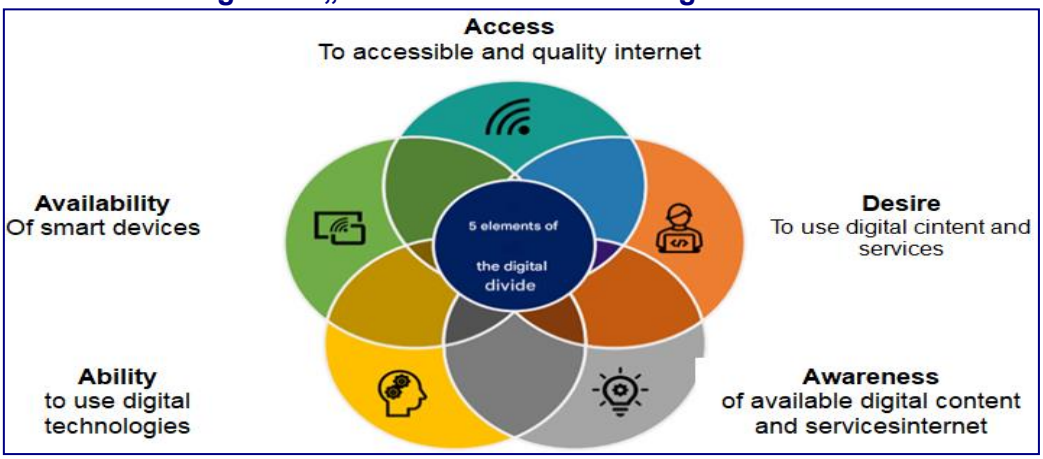
Another important step is the periodic publication of activity reports, which should also include performance indicators related to sustainability objectives, thus contributing to better institutional accountability.

Digital transformation is not primarily about introducing new technologies, but rather about redefining the way public institutions operate. The goal is to use technological solutions as tools to optimize processes, increase operational efficiency, improve interaction with beneficiaries, and promote a sustainable operating model.

Another important pillar of the public procurement reform is the ***stimulation of economic inclusion***. This can be achieved by introducing selection criteria that encourage the participation of small and medium-sized enterprises, social enterprises, as well as vulnerable

groups. Also, allocating percentages or prioritizing contracts with significant social impact, such as those that generate jobs for disadvantaged people, contributes to a fairer economy. Initiating tailored training and support programs for economic operators could facilitate access to public procurement procedures and increase the degree of competitiveness.

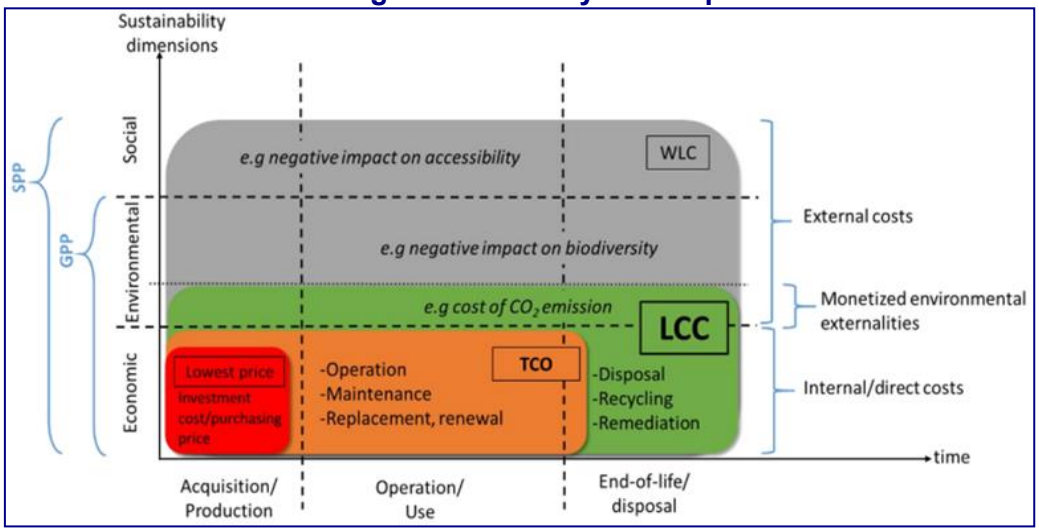
Figure 1: „The 5 Elements of the Digital Divide"



Source: Prepared by the authors based on the European Union Digital Compass [11]

Efficient and sustainable management of financial resources, in order to ensure responsible management of public funds, it is essential to adopt solid mechanisms for monitoring and controlling expenditure, so that the use of financial resources is as efficient as possible and aligned with the principles of sustainability. In this context, the budget planning process must be directly correlated with long-term strategic objectives, aiming not only at financial balance, but also at generating a positive social and environmental impact. At the same time, the implementation of relevant performance indicators will allow for a rigorous assessment of how the reforms contribute to economic stability and good governance of the procurement system.

Figure 2: „Conceptual model of assessing economic, social and environmental costs throughout the life cycle of a product"



Source: OECD (2020) [12]

The analyzed figure highlights the need for a conceptual and methodological transition in the field of public procurement, from an approach focused exclusively on the initial cost of the acquisition (lowest price) to one based on the total costs over the life cycle (Life Cycle Costing – LCC) and even on the total costs over the extended life cycle (Whole Life Costing – WLC). This holistic approach allows the integration of economic, social and environmental dimensions in the decision-making process, providing a complex perspective on the impact of procurement on sustainable development.

By assessing direct costs (acquisition, operation, maintenance) together with indirect or externalized costs (such as CO_2 emissions, biodiversity loss or the impact on social accessibility), life cycle analysis becomes an essential tool for promoting long-term efficiency and reducing negative externalities. In this context, sustainable public procurement is no longer just a procurement mechanism, but a strategic tool for achieving sustainability and good governance objectives.

Developing evaluation mechanisms, thus organizing rigorous monitoring and reporting processes of progress, in collaboration with civil society and relevant actors, contributes to transparency and accountability. At the same time, it is essential to develop an institutional learning framework, which allows for the continuous adjustment of policies and procedures and to maintain a constant dialogue between the public sector, the business environment and other stakeholders, to identify challenges and formulate sustainable solutions.

In recent years, both Romania and the Republic of Moldova have begun to recognize the importance of integrating sustainability principles into public procurement, as part of their commitments towards the circular economy and sustainable development. However, the level of development, implementation and institutionalization of sustainable public procurement differs significantly between the two countries.

As a member state of the European Union, Romania implemented in 2016 the new European directives in the field of public procurement by adopting a set of specific normative acts: „Law no. 98/2016 on public procurement", „Law no. 99/2016 on sectoral procurement", „Law no. 100/2016 on works and service concessions", as well as „Law no. 101/2016, which regulates the remedies in the procedures for the award of public procurement contracts, sectoral contracts and concessions, while also establishing the operating framework of the National Council for the Resolution of Complaints". At the same time, public institutions involved in the procurement process benefit from the support of the National Agency for Public Procurement, as well as other specialized bodies, in order to integrate sustainability criteria into the documentation related to the award procedures.

However, the provisions of the legislation have been amended several times since then, and legal instability is one of the weaknesses of the public procurement system.

On the other hand, in the Republic of Moldova, the concept of sustainable public procurement is relatively recently introduced into the public and administrative discourse. Although there are political commitments and reform initiatives, concrete implementation is still at an early stage. The lack of clear regulations, insufficient institutional capacities and the deficit of professional training among contracting authorities are factors that hinder progress in this area. However, the Republic of Moldova has initiated collaborations with international organizations and launched pilot projects aimed at promoting sustainable procurement.

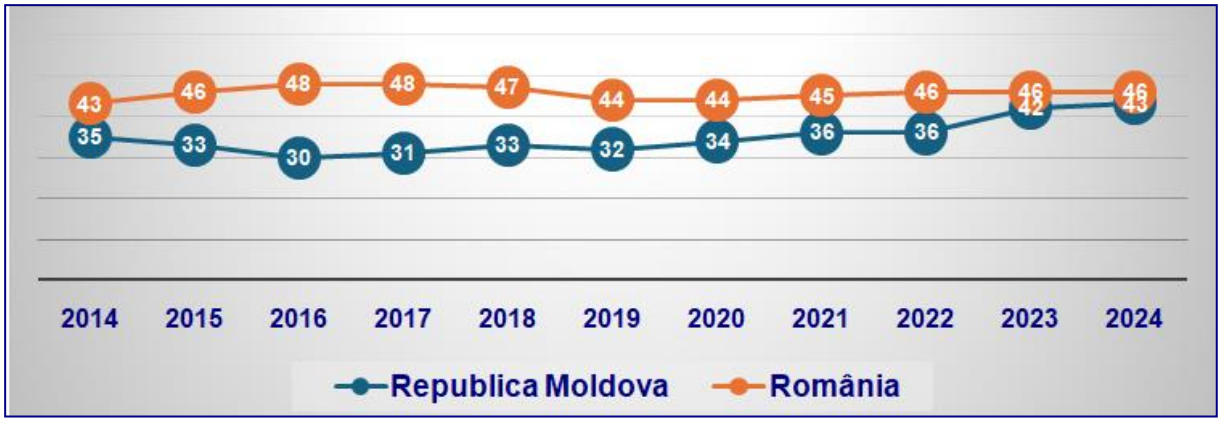
The legal framework governing public procurement in the Republic of Moldova is established by „Law No. 131 of 3 July 2015". Although this normative act regulates the essential aspects of procurement procedures, it does not explicitly provide for the integration of environmental criteria in the selection, award, technical specifications or contract performance clauses. Since 2014, the Republic of Moldova has launched a series of initiatives within the EaP GREEN regional programme, with the objective of promoting and adopting the principles of sustainable public procurement. Subsequently, since 2019, these efforts have been deepened by participating in the EU4Environment project, which included specific activities on sustainable procurement and the promotion of eco-labelling.

Significant progress was recorded in 2023, when the Government of the Republic of Moldova approved a Government Decision on the "Program for the Development of the Public Procurement System for 2023-2026". This decision aims to encourage contracting authorities to integrate sustainability criteria into procurement procedures. At the same time, the regulatory act establishes priority sectors and defines the institutional attributions of public procurement authorities in terms of monitoring and applying the criteria related to sustainable procurement at the national level.

The share of public procurement in the Gross Domestic Product in the Republic of Moldova is approximately 5%, while in Romania their share is about 11% of the Gross Domestic Product. The percentage difference highlights the different administrative and economic capacity of the two countries, as well as the level of integration of procurement policies into national development strategies. However, for both states, public procurement represents a major component of government spending, managing considerable funds from the public budget. Thus, the efficiency and sustainability of these processes have a direct effect on the balance of public finances, on the quality of services provided, but also on stimulating innovation and competitiveness.

However, the public procurement system in the Republic of Moldova and Romania is perceived as vulnerable.

Figure 3: „Corruption Perception Index (CPI) Republic of Moldova – Romania"



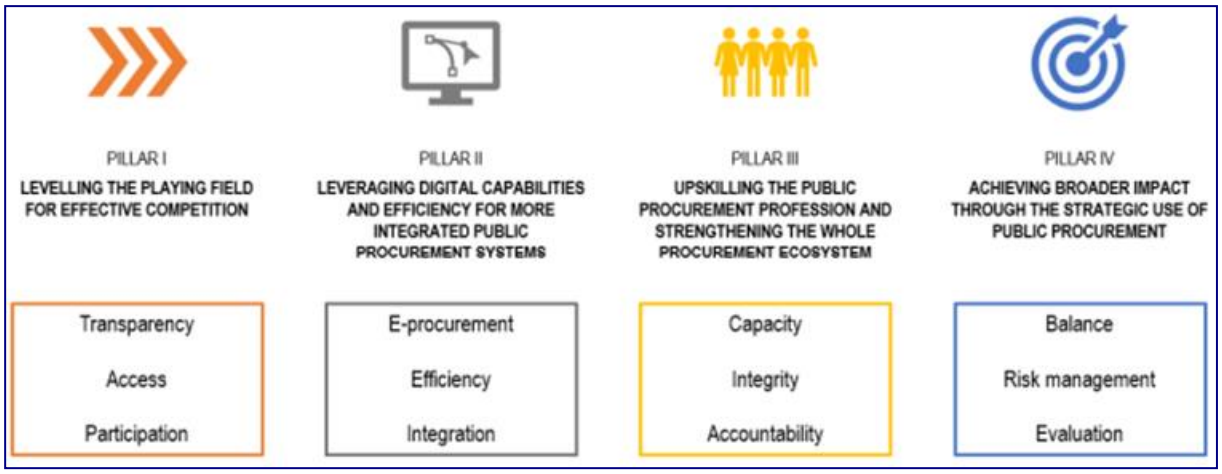
Source: Prepared by the authors based on the Transparency International

According to data provided by Transparency International, Romania obtained a score of 46 out of 100 in the Corruption Perceptions Index (CPI), while the Republic of Moldova recorded a score of 39 out of 100 [13]. These results highlight the fact that, although anti-corruption strategies have been adopted and progress is being made in certain areas, institutional

efforts must be intensified to strengthen the integrity system and reduce the perception of corruption.

Therefore, in order to increase the integration of sustainable public procurement in the Republic of Moldova and Romania and to achieve the necessary reforms mentioned in the research, the following recommendations are proposed:

Figure 4: „Recommendations on public procurement reform"



Source: Prepared by the authors based on the OECD report, 2024 [14]

Conclusions

In conclusion, this research has highlighted the strategic importance of public procurement reform as a fundamental tool for strengthening financial sustainability and stimulating inclusive economic development. The success of public procurement reform depends on rigorous implementation based on digitalization, constant professionalization of staff and a stable regulatory framework. By adopting a strategic vision, public procurement can no longer be treated as administrative tools, but must be approached as strategic levers, oriented towards transparency, efficiency and equity.

The comparative analysis between the Republic of Moldova and Romania highlighted significant differences in terms of the regulatory framework, the share of public procurement in GDP and the perceived level of corruption, thus highlighting the need for structural reforms adapted to the specific institutional and economic context of each country.

Romania, benefiting from the European regulatory framework and more consolidated implementation mechanisms, is aligning itself with the European dynamics of strengthening the role of public procurement in protecting and improving the quality of the environment, by using the principles of sustainable development in public procurement. In contrast, the Republic of Moldova, still in a reform process, faces challenges in terms of applying sustainability criteria, in particular due to institutional limitations and administrative capacity. However, the efforts and commitments undertaken at the strategic level allow the development of the sustainable public procurement process.

Thus, regardless of the level of administrative development, public procurement reform remains an essential condition for the efficient use of budgetary sources and for the

consolidation of a sustainable and inclusive economic growth model. Both Romania and the Republic of Moldova can substantially benefit from the modernization of this sector, provided that there is a coherent vision and a sustained political commitment.

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CIRCULAR ECONOMY - SLOW TRANSITION IN EU MEMBER STATES

Elena RUSU[35]

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Abstract:

This paper presents arguments regarding the security of implementing green public procurement at the European level. To conduct the study, the author approaches applicable traditional research methods: the monographic method, document analysis, comparison, trend analysis, etc. The conclusions arise as a result of the analysis of international documents, guidelines, and case studies, as well as reflection in order to provide for public spending on the procurement of products, services, and project care, promoting sustainable use.

Keywords: *circular economy, circular procurement, sustainable development, sustainable public procurement, green procurement*

JEL Clasification: H6; O3, Q01.

Introduction

The improvement and enhancement of public procurement practices is one of the key priorities of public authority management. The reasons for improvement stem from the reorientation of public policies aimed at reducing budgetary expenditures and decreasing the level of fraud associated with them, thus ensuring the acquisition of quality goods, works, and services under conditions of limited financial resources. Additionally, changes in the types of public procurement have led to a significant shift, namely the emergence of new approaches for sustainable procurement, whose contributions address issues of social, economic, and environmental development for both domestic and international enterprises.[1] Circular public procurement represents a solution for reducing public spending and protecting the environment, applied in many European countries.

Description of the problem

This paper presents arguments in support of the implementation of Circular Public Procurement at the European level.Thus, in the public sector, public services will be modernized with solutions for added value for money and better growth opportunities will be offered to companies[4].

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Metodology and Data

To carry out the study, the author applied traditional research methods: the monographic method, document analysis, comparison, trend analysis, etc. The conclusions arise as a result of the analysis of international documents, guidelines, and case studies, and reflect that circular public procurement aims to spend public funds on the purchase of products, services, and projects that promote sustainable development.

Results

The key distinction between traditional public procurement and sustainable public procurement is that the former exclusively concerns value for money at the time of purchase, while circular public procurement takes it a step further and considers the social, environmental, and economic dimensions of procurement throughout the entire lifecycle of the product or service.[3] During the 10 years of activity within the United Nations Conference on Sustainable Development (Rio + 20), programs on sustainable consumption and production patterns were adopted in June 2012 (10YFP). The 10YFP is a global framework for strengthening international cooperation and accelerating the transition to sustainable consumption and production (SCP) models in both developed and developing countries. The concept of a circular economy (CE) is very broad and covers a range of related topics in production and consumption, including resource efficiency, waste hierarchy, and the shift to resourcesthe hierarchy of waste, the transition to renewable resources for both materials and energy, and many others. This scope is the strength of the EC. The circular economy replaces the linear approach, based on resource exploitation, unsustainable production, and consumption with a circular, sustainable approach that yields benefits for economic, social, and environmental capital. Ultimately, the system to which we aspire produces neither waste nor pollution, allowing resources, materials, and products to circulate at the highest quality within the production system and, if possible, reusing materials in the biosphere to restore natural capital (biodiversity and ecosystems) at the end of the life cycle. In this way, the use of natural resources and the negative impact on the environment are reduced, while contributing to the increase of human well-being [4].

To achieve the transformation of a linear system into a circular one, while benefiting from these advantages, the circular economy is based on practices and solutions that cover a wide range of strategies at different stages of the value chain. These can be grouped as follows: [2]

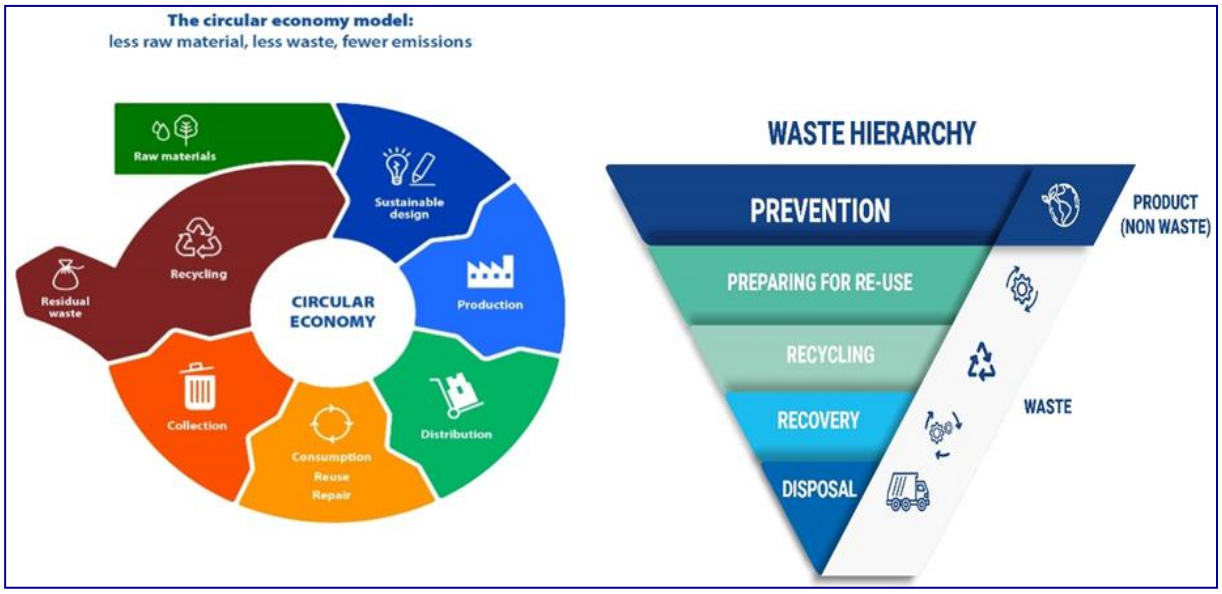
• Closing material loops: replacing raw materials or new products with secondary materials and second-hand, repaired, or refurbished products or parts;

• Slowing material flows: extending the lifespan of products through better design, maintenance, and repairs;

• Reducing material flows: using fewer resources per product or using fewer products to provide the same service to society.

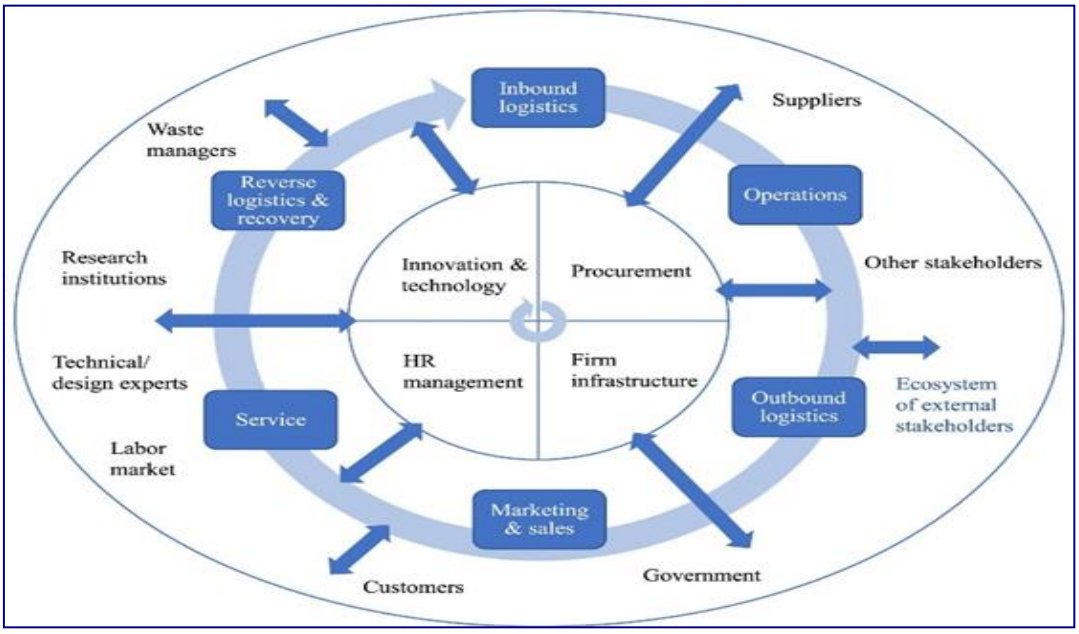
To minimize the environmental impact, products and production processes must be redesigned in accordance with the principles of the circular economy and the EU priority regarding waste prevention (see figure 1). Approximately 80% of a product's environmental impact is determined by how it is designed.

Figure 1: The stages of the circular economy compared to waste prevention in the EU



In order to enhance the efficiency of public procurement for strategic advancement, the objectives largely depend on public solidarity, the procurement framework itself, and its principles and practices, as well as whether these objectives are aligned with existing national, regional, and international policies. For example, government procurement can support the implementation of national energy policies aimed at achieving international objectives, such as reducing greenhouse gas emissions. Circular economy action plans (CEAPs) are part of the strategic framework for the circular economy of the Commission (figure 2).

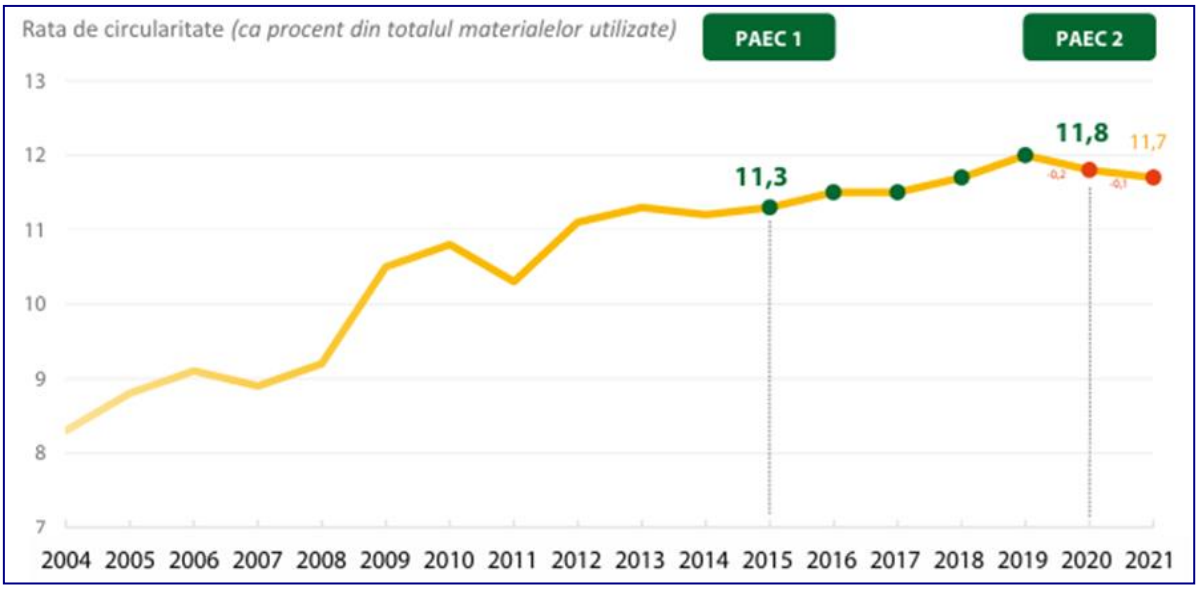
Figure 2: The EU's strategic framework for the circular economy



Source: [8]

These plans include four types of actions: ensuring an appropriate regulatory framework (e.g., directives, implementing regulations); cross-cutting measures to establish policy guidance in areas such as innovation and investment (such as the development of horizontal testing schemes) to stimulate the transition to a circular economy; allocating funding from the Union for projects that accelerate progress towards circularity; and monitoring the Union's progress towards a circular economy.Member states are increasingly focusing on the circular economy, but progress is slow and there are issues regarding monitoring. PAEC 1 included an action for the Commission to develop a monitoring framework for measuring the EU's transition to a circular economy. This framework used existing data from Eurostat and other official sources. The framework was delivered in 2018 and included the indicator regarding the 'circular material use rate.' This indicator, also known as the 'circularity rate,' measures the percentage of recycled materials reintroduced into the economy.Some international organizations and national authorities consider it an indicator of the overall progress of countries towards a circular economy. The Commission itself has used this indicator to establish the PAEC 2 goal for 2030 and in its annual country reports, to highlight the successes achieved by member states in reaching the goals of the circular transition.[6]
The circularity rate in the EU for 2021, at 11.7%, is higher than the most recent global circularity rate, which reached 7.6%, down from 9.1% in 2018.

Figure 3: Progress made in EU-27 towards a circular economy.



Source: European Court of Auditors, based on Eurostat circular material use rate.

Fig. 3 also shows that there are significant variations in terms of circularity rates among member states; some use much more recycled materials than others.

Traditionally, economies tend to follow a linear cycle of production-use-disposal. However, a circular economy keeps the value of products, materials, and resources for as long as possible and minimizes waste. For citizens, this means that products last longer and/or are easier to repair, upgrade, remanufacture, reuse, or recycle. For businesses, it offers the opportunity for more efficient use of resources. The way a product is designed determines approximately 80% of its environmental impact. In order to minimize environmental impact, products and production processes must be redesigned according to the principles of the

circular economy and the EU's priority related to waste prevention. One positive aspect is that, since the publication of the first action plan, activities related to the circular economy undertaken by the governments of member states have increased, for example of Ireland, Netherlands and Poland.[6]

The Netherlands strategy, adopted in autumn 2016, set the objectives of reducing the use of primary raw materials by 50% by 2030 and achieving a fully circular economy by 2050. The strategy covers aspects of all stages of the circular economy, including circular design, with direct references to PAEC 1.

The roadmap for circular economy in Poland in 2019 included relevant actions for the design and production stages of the circular economy, relying on PAEC 1. In July 2022, the Polish government adopted its new Productivity Strategy, aimed at guiding future support for the transition to a circular economy in Poland. To measure the transition, the government decided to monitor other indicators than those used by the Commission (for example, 'resource productivity')[7].

In 2020, the Irish government adopted the Waste Action Plan for a Circular Economy, a roadmap for waste planning and management. The main objectives of this plan focused on directing attention towards eliminating harmful waste or designing without harmful waste, as well as extending the lifespan of products and goods through reuse and preventing the generation of waste in the first place. In December 2021, the government adopted the Circular Economy Strategy at the whole government level, which included the objective of increasing the circularity rate in Ireland above the EU average by 2030[7].

Today, in our country, despite the adoption of the new law on public procurement and the ongoing adjustments made to it, the legal framework regarding public procurement is not aligned with EU directives in the field and does not ensure the efficiency and transparency of the public procurement process [6].

Conclusions

In conclusion, I mention that circular public procurement aims to spend public funds on the procurement of products, services, and projects that promote sustainable and durable development. Circularity issues are becoming vital in the development agenda of a nation; it is time to focus on public procurement systems, mainly on the immediate economic advantages for sustainable public. It is necessary for circular public procurement systems to yield long-term benefits not only for governments but for all their representatives.

Future Directions

For European authorities as well as for national authorities, a series of recommendations are presented:

❖Improving the monitoring of member states' transition to a circular economy;
❖ Analyzing the reasons for the low use of EU funding for circular design and examining the possibility of increasing incentives in this regard.
Although it is a relatively new concept, circular procurement is not another type of procurement; rather, it seeks to address the ecological, social, and economic consequences, from design to manufacturing or use, through procurement actions.

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THE DIGITAL TRANSFORMATION OF SMALL AND MEDIUM-SIZED ENTERPRISES - OPPORTUNITIES AND PERSPECTIVES

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Abstract:

This paper addresses the need for digital transformation of SMEs in the Republic of Moldova as a predominant factor in ensuring the competitiveness of enterprises. The research aims to identify solutions for the digital transformation of SMEs in the Republic of Moldova to increase their competitiveness. At the same time, the need for digital transformation is punctuated by the changes that occur at a rapid pace in the external environment, which pressures SMEs to quickly adapt and integrate new information technologies into their activity, to increase competitiveness. From the need to face competitors, SMEs have to identify ways to innovate, optimize processes, and increase the human capital of their employees and thus raise their competitiveness. The research methodology focused on the use of the following research methods: analysis, synthesis, induction, deduction, abduction, and a few others. Finally, we can note that, at a national level, it is necessary to develop a digital transformation program for SMEs that would help organizations, through concrete activities, projects, and financial means, support and consultancy, in the effort to achieve competitiveness.

Key Words: *digital transformation, digitization, SME, competitiveness, information technologies.*

JEL classification: *L20, M51, O30, O31, O32*

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Introduction

The digital economy has taken over all fields of human activity and completely transformed them, embracing an active approach to make them more efficient. Therefore, implementing information technologies in business activities has become a dire necessity in the 21st century, a century defined by digitalization. The classical business management models have given way to new models of digital transformation.

Information technologies such as the Internet of Things, 5G, Big Data, Blockchain, and AI are helping companies achieve higher productivity and greater relevance on the market globally.

Content

The digitalization of SMEs provides a wide range of advantages. Nevertheless, it also involves certain vulnerabilities, as shown in Table 1.

Table 1. Advantages and vulnerabilities of the SME digitalization

Advantages	Vulnerabilities
Generating new products and services	Substantial alterations in terms of consumer demand
New flows of information and knowledge	Fast wear and tear of digital products
Digital interconnectivity	Acquiring digital skills by human resources
Easy access to clients and capital markets	Interconnection of different technologies
Optimizing processes	Cybersecurity

Source: developed by the authors of the present article

In the 21st century, the classic economy has given way to a strongly interconnected digital economy that, by default, favors intangible products. Information technologies are part of a sector that optimizes and streamlines the classical economy in all areas, being able to disseminate essential information promptly, regardless of the distance between the source and the beneficiary of the information. Technologies such as IoT, 5G, Big Data, Blockchain, and AI assist companies in getting a higher flexibility of the supply chain, contribute to increased data security, advance remote work capabilities, and automate processes. Combining these technologies leads to a digital change in terms of products, processes, and business models [6].

According to the report on public policies for SME digitalization, digitalization has a significant and transformative impact on the European Union [6]:

▪The ICT industry contributes 4% to EU GDP and employs more than 9.1 million people.

▪In the EU, the digital economy creates five jobs for every 2 offline jobs lost.

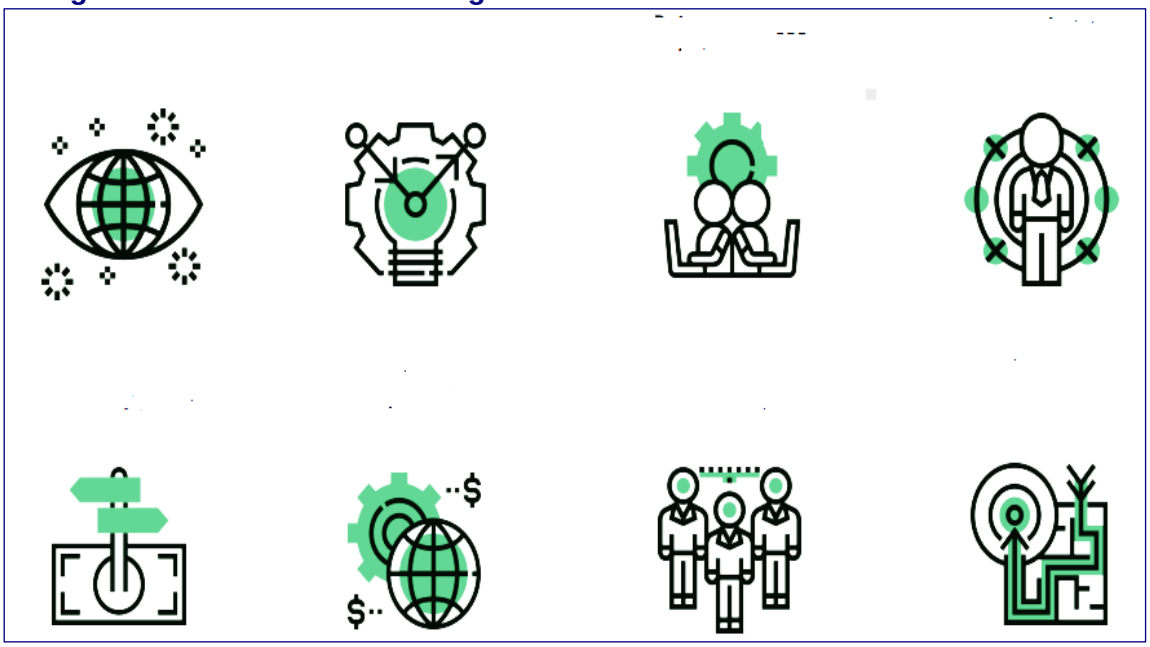
▪The digital economy of the EU is 12% higher by the year, and it is estimated that there are more mobile phone subscriptions than people in the EU.

▪It is also estimated that in the EU, half of the growth in the productivity of companies comes from investments in information and communications technology.

According to the World Economic Forum, in 2023, these are the technologies that are currently affecting and transforming the business environment, as shown in Figure 1.

The SMEs that wish to become more competitive and reach a higher level of strategic competitiveness must include within their activities modern technologies that help them optimize their processes, enhance the skills of their human resources, and overall improve the quality of their services and products. On the other hand, SMEs that implement information technologies have higher flexibility and capacity to adjust to the changes inflicted by the external environment.

Figure 1: Information technologies that transform the business environment



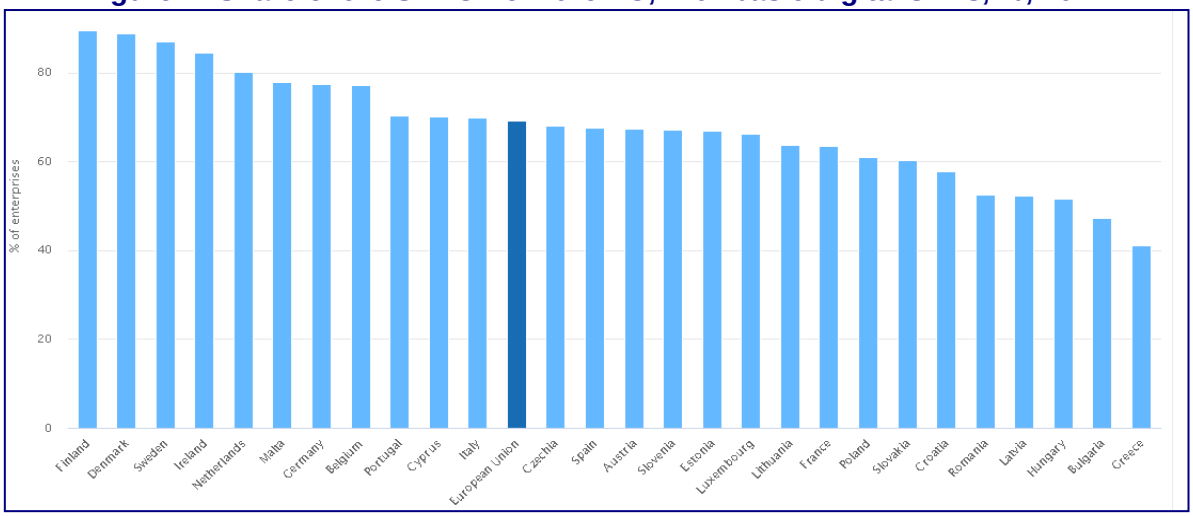
Source: Report on public policies for SME digitalization
Available: https://www.oirbi.ro/wp-content/uploads/2021/01/40Ready_Raport-OIR-_RO.pdf

Digitalization has expanded and accelerated at a higher pace in recent years, especially for SMEs. The revolution started by Industry 4.0 is not represented by technologies but by people. Nowadays, big companies in manufacturing industries are undergoing a profound digital change, aimed at streamlining increasingly complex production processes through new technological solutions to meet customer needs. [4].

The European Commission, through the agency of the Digital Agenda for Europe, associates digital competences with a modern economy, having the main strategic objective of promoting digital competences.

The analysis of the data provided by the DESI report for 2023 reveals that 70% of the SMEs from the EU have basic digital competencies in terms of the usage of information technologies. Accordingly, the leaders in the digital skills ranking are SMEs from Finland with 90%, Denmark with 89% and Sweden with 88%. At the same time, the last positions in the ranking are occupied by SMEs from Hungary with 52%, Bulgaria with 48% and Greece with approximately 41%.

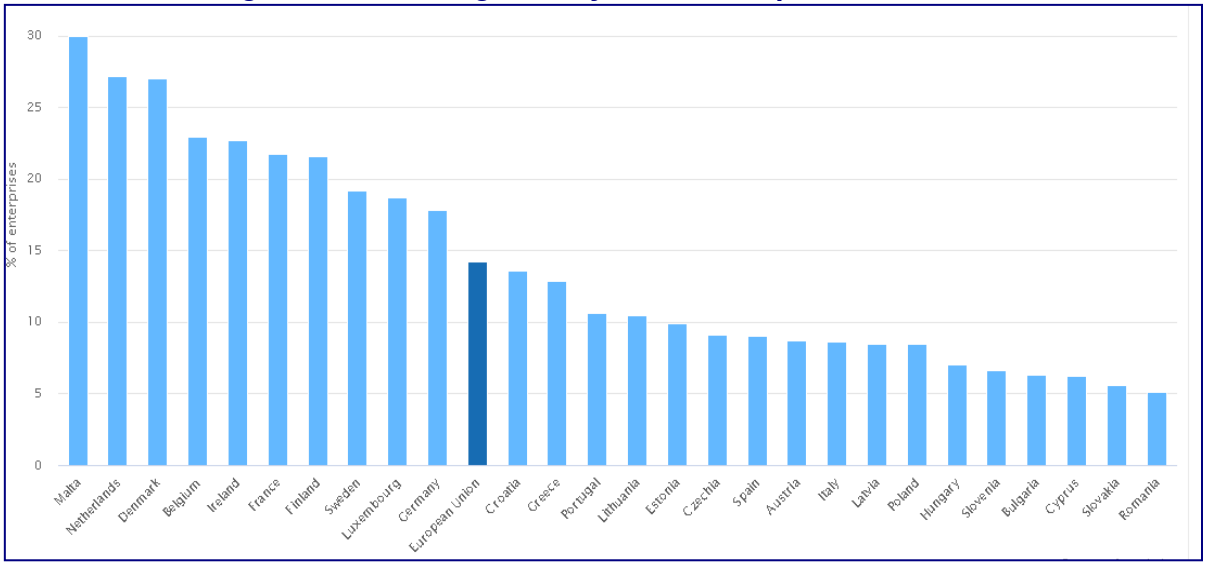
Figure 2: Share of the SMEs from the EU, with basic digital skills, %, 2022



Source: European Commission, DESI Report, 2023.

Regarding digital competences, the 2023 Digital Economy and Society Index (DESI) report shows that in the EU, the share of enterprises using Big Data is relatively low.

Figure 3: Use of Big Data by the UE companies, %, 2022

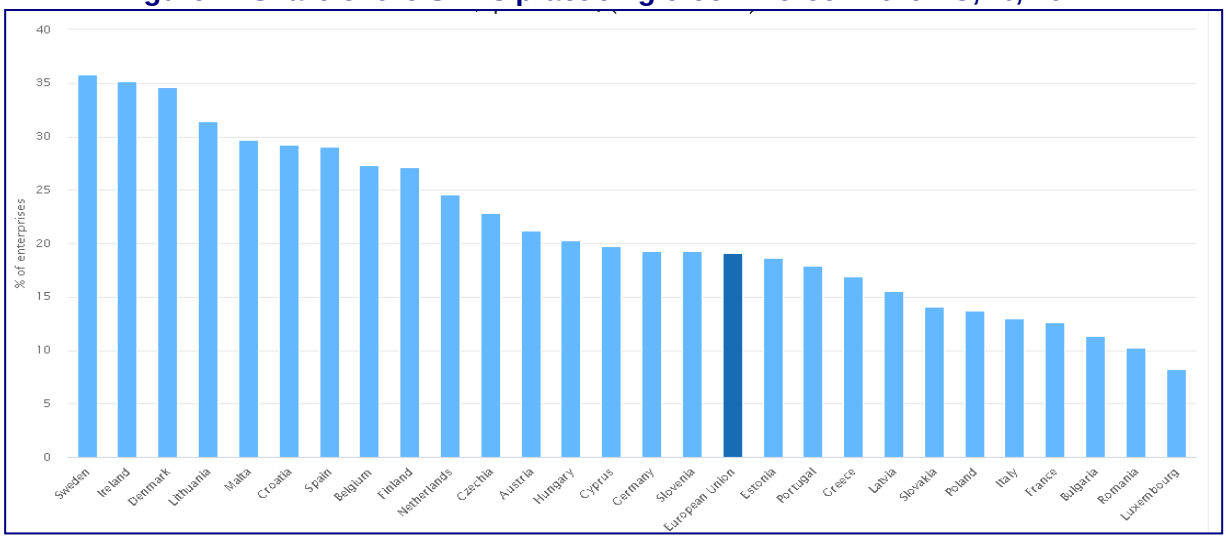


Source: European Commission, DESI Report, 2023.

Based on the analysis of the data shown in Figure 3, the SMEs from Malta have a leading position in DSI ranking, in terms of implementing Big Data, where approximately 30% of the SMES of the country include Big Data technology in their practices, while the SMEs from Romania achieve only 5% in terms of Big Data usage and thus occupy the final position in this ranking.

On the other hand, it is quite good news that a large part of the SMEs in the European Union practice electronic commerce, which allows them to be more competitive, flexible, and expand into new markets.

Figure 4: Share of the SMEs practicing e-commerce in the EU, %, 2022



Source: European Commission, DESI Report, 2023.

If we analyze the data included in Figure 4, we can notice that practicing e-commerce in the EU is a successful activity that brings many competitive benefits to the SMEs. Accordingly, the top leaders of e-commerce usage by enterprises in the EU are SMEs from Sweden, where 36% of the country's SMEs practice e-commerce, Ireland with 35%, and Denmark with 34%. The last positions in this ranking are occupied by SMEs from Bulgaria with 12%, Romania with merely 10% and, surprisingly, Luxembourg with just 8%. If we were to perform an analysis on the digitalization of the SMEs in the Republic of Moldova, we could mention that in 2022, the SME sector represented roughly 99,2% out of the total number of enterprises, generating 44,9% of sales revenue and employing 65.6% of private sector employees. On the authority of the latest data provided by the National Bureau of Statistics, approximately 80.3% of SMEs in the country have secured internet access, but only 17% of SMEs have successfully integrated digital technologies into their activity, which highlights a dire need for digital transformation in this sector [1].

According to a study conducted by USAID experts in the Republic of Moldova, there are sufficient elements for e-commerce development in the country, yet expert data shows that less than 20% of the country's companies practice online commerce [1].

Based on the analysis of the Digital Transformation Strategy of the Republic of Moldova for 2023-2030, as of March 31, 2023, out of the 517 public administrative services (G2B) registered with AGE, 204 services are available online, namely 33.4%. On the other hand, out of the 473 public services available, G2C, 32.5% or 154 services are provided online. The ICT sector has become the main driver of digitalization and innovation in the Republic of Moldova and has registered exponential growth in recent years. In 2021, the IT industry reached a share of over 4.2% of the gross domestic product (GDP), exceeding 10 billion lei in sales, the share of the ICT sector being over 7.6 percent of GDP with over 18 billion Lei in sales in 2021, achieved by approximately 2,000 companies with over 30,000 employees [7].

According to the NBM report for 2022, the export of ICT services reached 501.85 million USD. IT exports have been growing at an annual rate of over 30 percent over the past 5 years and reached a record high of 468.67 million USD in 2022. The 7% flat tax on sales revenue offered by Moldova IT Park and the wide range of eligible activities, including ICT research and development (R&D), have given a significant boost to the development of the ICT sector. In just five years of activity in this field, Moldova IT Park has become one of the

most successful development initiatives of the IT domain in the country, drawing 1,395 residents, 18,700 employees (68% males, 32% females), and a forecasted revenue for 2023 of over 10.7 billion Lei [7].

Based on the Speedtest Global Index (https://www.speedtest.net/globalindex) that provides a monthly comparison of Internet access speed data for 100 countries around the world, the Republic of Moldova ranks 58th, in terms of mobile broadband speed (with a download speed of 38 Mbps, compared to the global average of 48 Mbps) and 38th in terms of fixed broadband speed (with a download speed of 106 Mbps, higher than the global average of 98 Mbps). The Republic of Moldova is in the top 10 countries in the world in terms of accessibility and affordability of Gigabit Internet access, where users have access to unlimited Gigabit Internet for approximately 15 Euros per month [3].

The Entrepreneurship Development Organization, in an effort to boost the digital transformation process of SMEs in the Republic of Moldova, has implemented the Digital Transformation Program aimed at providing financial support to SMEs, more precisely to digitize business processes. Accordingly, the financial resources are granted by EDO as non-refundable financial support and can be used in the following directions [4]: purchase of ICT hardware and other related devices and equipment, including installation, configuration, commissioning costs, as long as they are justified by project implementation; purchase and/or development and/or adaptation of software applications/licenses necessary for project implementation, configuration and implementation of databases, migration and integration of various existing data structures; purchase and/or development and/or adaptation of complex ERP/CRM automation systems; purchase of new technological gear, systems, machines, tools, and work tools, necessary for the digitalization, innovation and modernization of the operational process, etc.

Conclusions

Based on the research conducted, we can highlight multiple vulnerabilities in the digital transformation of SMEs in the Republic of Moldova, such as:

a. Deficiency of legal acts on the implementation of new digital technologies, namely Artificial Intelligence (AI), Blockchain, Internet of Things (IoT), Big Data, and mining, and insufficient adaptability of the legal framework to the existing digital business models.
b. Insufficient institutional capacity for implementing the Agenda of Digital Transformation.
c. SMEs manifested reluctance towards digital transformation.
d. Deficiency of digital skills for the digital transformation of SMEs.
e. Underdeveloped ICT infrastructure within SMEs.
f. Low levels of ICT investment in agricultural SMEs.
g. Low involvement of local companies in state-funded IT projects.

Consequently, there is a rising need to increase the funding provided by the EU and international partners to streamline the digital transformation process of SMEs in the Republic of Moldova through investments in the purchase of hardware and software equipment that are extremely necessary for the digitalization of SMEs.

Concurrently, it is necessary to create support/consulting centers, as well as educational centers for entrepreneurs to help them learn how to implement information technologies, since the digital education of entrepreneurs does not allow them to generate and implement ICT in their business activities.

On the other hand, it is necessary to simplify customs procedures for online exports, grow the online trade, promote cooperation in the field of research, development, and innovation between the public and private sectors, and consolidate the electronic payment

market. These are just a few measures that will help SMEs in the Republic of Moldova to successfully engage in choosing the path of digital transformation.

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FINANCIAL CHALLENGES OF INVESTING IN ECO-INNOVATION

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Abstract:

Eco-innovation represents the entrepreneurial and innovative potential of companies aimed at sustainable business practices based on the introduction and development of eco-innovations. Sources of financing for eco-innovation include bank loans, green loans, as well as external funding sources. The research in this paper focuses on the analysis of financial support measures for eco-innovation from the perspective of their relevant impact on fostering eco-innovations. By applying quantitative and qualitative research methods grounded in an analytical approach, the study examines the National Recovery and Resilience Plans (RRP) of EU countries in relation to the achieved Eco-Innovation Index in the domains of Eco-Innovation Inputs and Eco-Innovation Outputs. The obtained results are synthesized to underscore the need for enhanced financial support, viewed through the lens of how direct and indirect measures contribute to various relevant dimensions of eco-innovation.

Keywords: *finance, financial support measures, statistical analysis, eco-innovation, Eco-Innovation Index*

JEL classification: *G11, G23, Q56*

Introduction

The concept of eco-innovation is most commonly examined in the context of its contribution to waste reduction and environmental initiatives within business processes (Janahi et al., 2021). In this regard, the role of eco-innovation in promoting efficient resource use and cleaner production is analyzed (Malinauskienė et al., 2018; Spirko et al., 2016).

The integration of innovation and sustainability fosters the development of innovations that have a positive environmental impact, commonly referred to as sustainable innovations, green innovations, ecological innovations, or eco-innovations (Carrillo-González et al., 2025), which in turn support green supply chain management (GSCM). GSCM encompasses strategies for supply chain development, green investments, and the sustainability of both enterprises and governmental institutions, where the strategic implementation of GSCM encourages value co-creation and positively affects firm performance in terms of innovation and financial outcomes (Xu et al., 2020).

Given the increasing number of stakeholders involved in the development and maintenance of eco-innovations, the literature emphasizes the importance of public support and policy

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programs, which, through governance models and financing mechanisms, provide support for the circular economy—such as the Recovery and Resilience Plan (RRP).

The European Commission adopted the RRP as a strategic document that each EU Member State prepares within the framework of the Recovery and Resilience Facility (RRF), which serves as the central instrument of the EU's "NextGenerationEU" recovery package. The goal is to strengthen economic resilience, foster green and digital transitions, support innovation, ensure sustainability, and promote social inclusion (EC, 2022a; EC, 2022b).

The RRF defines six policy areas that Member States must address in their National Recovery and Resilience Plans (NRRPs), as outlined in the European Commission Regulation 2021/241: green transition, digital transformation, smart, sustainable, and inclusive growth, social and territorial cohesion, health, economic, social and institutional resilience, and policies for future generations.

Financial resources available through the RRF represent a significant opportunity to accelerate eco-innovation (EU Eco-Innovation Index 2022, 2022). To measure and monitor the performance of EU countries in transitioning toward a climate-neutral and circular economy, the Eco-Innovation Index was developed (Green Forum, EC Europa, 2022; EU Eco-Innovation Index 2022, 2022).

Literature Review

The research is based on the following theoretical approaches: the drivers of eco-innovation include institutional factors and public policies, as well as market, economic and financial, behavioral, technological, and organizational factors (Diaz Lopez & Montalvo, 2015; Orjuela-Ramirez et al., 2024). Eco-innovations lead to the development of various types of business models that enable reuse, remanufacturing, green products, and other sustainable practices (Chioatto et al., 2024).

The literature analyzes the sources of financing for eco-innovation and highlights the evolution of financing forms and models, from traditional sources to green financial instruments. Funding sources are classified into traditional bank loans and green loans, as well as external sources of financing, including EU funds, government grants, and crowdfunding (Incekara, 2021).

The literature examines the sources of financing for eco-innovation, emphasizing the evolution of financing forms and models from traditional sources to green financial instruments. Funding sources are classified into traditional bank loans and green loans, as well as external financing sources such as EU funds, government grants, and crowdfunding (Incekara, 2021).

In addition, the literature highlights the importance of green finance as a key driver of the sustainable transition (Marín-Rodríguez et al., 2024), as well as its impact on the development of green patents and the improvement of firms' business performance (Marín-Vinuesa et al., 2018).

Innovative financing models for eco-innovation are also discussed, particularly those based on project-based innovation financing, which mobilizes private capital for sustainable infrastructure development (González-Ruiz et al., 2018; Morea & Gebennini, 2021).

The role of green financial instruments is reflected in the production of renewable energy (Alharbi et al., 2022), improvements in energy efficiency, and enhanced ESG performance of enterprises (Zhao et al., 2024). Green finance and green investments increasingly

incorporate impact investing, where investors accept lower financial returns in exchange for generating social and environmental benefits (Fu et al., 2023).

The literature also examines the financing of eco-innovations through the Recovery and Resilience Plan (RRP), highlighting the sectoral and structural reforms stimulated by these financial instruments. A 2024 European Commission study explores tools for analyzing the macroeconomic impact of structural reforms, noting that the evolution of these programs remains a challenge (García et al., 2024).

Furthermore, the 2025 European Commission study reveals that more than 2,800 sectoral reform and investment measures financed through the Recovery and Resilience Facility (RRF) are projected to generate a total economic impact of €891.7 billion for the EU by 2030—comprising €546.2 billion in direct effects and €345.5 billion in indirect (spillover) effects (Joint Research Centre, 2025).

The application of the FIDELIO model (an economic impact assessment model) is used to evaluate the direct and indirect effects of RRF funding across sectors and EU Member States (Michels et al., 2025).

A review of the aforementioned studies shows that while the implementation measures and effects of the RRF are analyzed, the value of the Eco-Innovation Index is not explicitly linked to the financial framework or the allocation of monetary resources.

Methodology and Data

The research is based on a combination of quantitative and qualitative methods aimed at examining the relationship between eco-innovation, as measured by the Eco-Innovation Index, and financial support provided through the Recovery and Resilience Facility (RRF).

The research design consists of a descriptive and comparative analysis of the Eco-Innovation Index and RRF financial allocations, as well as a rank analysis to assess the relationship between the Eco-Innovation Index and Eco-Innovation inputs.

Data sources include: Eco-Innovation Index (EU, Eco-Innovation Index Reports, 2022), RRF financial data (European Commission, Country Reports, 2022), and Policy documents, specifically national Recovery and Resilience Plans (European Commission, Country Profiles, 2022).

Results

The Recovery and Resilience Facility (RRF) was developed as a key instrument of the EU's NextGenerationEU recovery plan in response to the crisis caused by the COVID-19 pandemic. The primary objective of the RRF is to enhance resilience and support the green and digital transitions, with a total budget of €650 billion (Recovery and Resilience Facility, 2022).Financial resources under the Recovery and Resilience Plans (RRPs) are allocated in the form of RRF Grants and RRF Loans.

The data analysis shows that the majority of financial resources within the Recovery and Resilience Plans (RRP) are allocated as RRF grants (54.21%), with the largest amounts directed to Italy, Spain, and Poland—together accounting for 65.34% of the total funding. The smallest allocations were observed in Ireland, Cyprus, and Denmark.

The Value of the Eco-Innovation Index as a Measure of National Economic Progress: The Eco-Innovation Index assists in monitoring the performance of EU Member States in terms of

eco-innovation, where eco-innovation and the circular economy are strategic investment priorities. The Eco-Innovation Index encompasses five key areas (Green Forum, EC Europa, 2022):

Eco-Innovation Inputs: Financial and human investments in eco-innovation (research budgets, education, number of researchers).
Eco-Innovation Activities: Company engagement in eco-innovation (ISO 14001 certifications, number of involved firms).
Eco-Innovation Outputs: Outcomes of activities, such as the number of patents and scientific publications in the field of eco-innovation.
Resource Efficiency Outcomes: Efficiency in resource use (water, energy, raw materials) as well as greenhouse gas (GHG) emission intensity.

Socio-Economic Outcomes: Positive social and economic impacts of eco-innovation (e.g., number of green jobs, growth of the green sector, exports from the eco-industry).

The Eco-Innovation Index showed a steady increase from 2013 to 2022, with positive trends observed in the improvement of the GHG emission productivity indicator, which contributed to the overall growth of the Index values: Austria from 5.1 to 6.2, Germany from 3.2 to 5.0, and Ireland from 2.9 to 6.0. However, negative trends were recorded in eco-innovation activities, specifically in ISO 14001 certifications, eco-innovation patents, and exports of products from the eco-industry (EU Eco-Innovation Index, 2022).

Table 1: Eco-Inovation Index in 2022

EU	Eco-Innovation Index	Eco-innovation activities	Eco-innovation inputs	Eco-innovation outputs
Austira	0.721	0.254	0.781	0.641
Belgium	0.414	0.124	0.577	0.515
Bulgaria	0.239	0.567	0.155	0.147
Croatia	0.368	0.570	0.211	0.319
Cyprus	0.393	0.504	0.082	0.546
Czechia	0.460	0.777	0.615	0.258
Denmark	0.695	0.288	0.799	0.916
Estonia	0.479	0.809	0.248	0.518
Finland	0.738	0.566	0.853	0.883
France	0.542	0.136	0.822	0.399
Germany	0.585	0.192	0.879	0.673
Greece	0.421	0.284	0.702	0.373
Hungary	0.337	0.583	0.498	0.197
Ireland	0.458	0.287	0.337	0.481
Italy	0.537	0.577	0.603	0.319
Latvia	0.437	0.320	0.263	0.463
Lithuania	0.430	0.558	0.274	0.337
Luxembourg	0.742	0.222	0.493	0.764
Malta	0.331	0.130	0.123	0.187
Netherlands	0.493	0.239	0.516	0.536
Poland	0.279	0.083	0.252	0.282
Portugal	0.438	0.113	0.445	0.394
Romania	0.351	0.547	0.174	0.177
Slovakia	0.392	0.673	0.282	0.240
Slovenia	0.480	0.459	0.672	0.551
Spain	0.483	0.546	0.464	0.291
Sweden	0.667	0.544	0.744	0.832

Source: EU, Country profiles, 2022.

The analysis of the data presented in Table 1 shows that the Eco-Innovation Index has an EU average of 0.4523, with the highest values recorded in Luxembourg, Finland, and Austria. The lowest values were observed in Bulgaria, Poland, and Malta.

The Eco-Innovation Inputs have an EU average of 0.4944, with the highest values in Germany, Finland, and France, and the lowest values in Bulgaria, Malta, and Cyprus.

Based on the aforementioned relationships, rank positions of countries with the highest values of the Eco-Innovation Index and Eco-Innovation Inputs were determined.

Table 2: Rank Eco-Innovation Index and Eco-Innovation inputs

EU	Rank Eco-Innovation Index	Rank Eco-Innovation inputs	Deviation
Luksemburg	1	14	+13
Finland	2	2	0
Austria	3	5	+2
Germany	6	1	-5
France	7	3	-4

Source: Author, based on EU, Country profiles, 2022.

There is no observed impact of the size of RRF funding on the Eco-Innovation Index for countries with the highest Eco-Innovation Index values, which can be explained by the fact that RRF funds are not solely intended to strengthen eco-innovation. However, the relationship between Eco-Innovation Inputs and the Eco-Innovation Index demonstrates a direct impact and a stronger connection between the scale of investments directed towards eco-innovation and the contribution to enhancing the eco-innovative capacity of national economies. This relationship is most evident in the case of Finland and least pronounced in Luxembourg.

The analysis of direct and indirect financial support measures is based on the classification of EU Member States into three categories (Author, based on Country Profiles, 2022):
- Countries that have identified the relevance of eco-innovation and have explicitly reflected the contribution of direct and indirect financial support measures to eco-innovation;
- Countries that have identified the relevance of eco-innovation but have not expressed this through the contribution of direct and indirect financial support measures;
- Countries that have neither identified the relevance of eco-innovation nor expressed any contribution of direct or indirect financial support measures to eco-innovation.

The segmented analysis based on the three groups shows the following (Table 3; Figure 1):
1) Ten countries have demonstrated the contribution of both direct and indirect financial support measures to eco-innovation: Austria, Bulgaria, Czechia, Denmark, Finland, Germany, Italy, Latvia, Slovakia, and Luxembourg.
Luxembourg implemented measures contributing to eco-innovation by addressing climate action, circular economy, and biodiversity protection. One such support instrument is the Fit4Circularity program. Luxembourg is the only country that has evaluated the impact of these measures on eco-innovation using a scale-based approach (low, medium, and high). All three measures were rated as low in terms of direct impact on eco-innovation, while Fit4Circularity was assessed as having a high impact specifically on the circular economy.
Countries expressed their relevance to eco-innovation through the following types of activities:
Cross-cutting – Implementing intersectoral approaches to strengthen eco-innovation.
Introduction of eco-design – Designing products that minimize environmental impact throughout their life cycle.

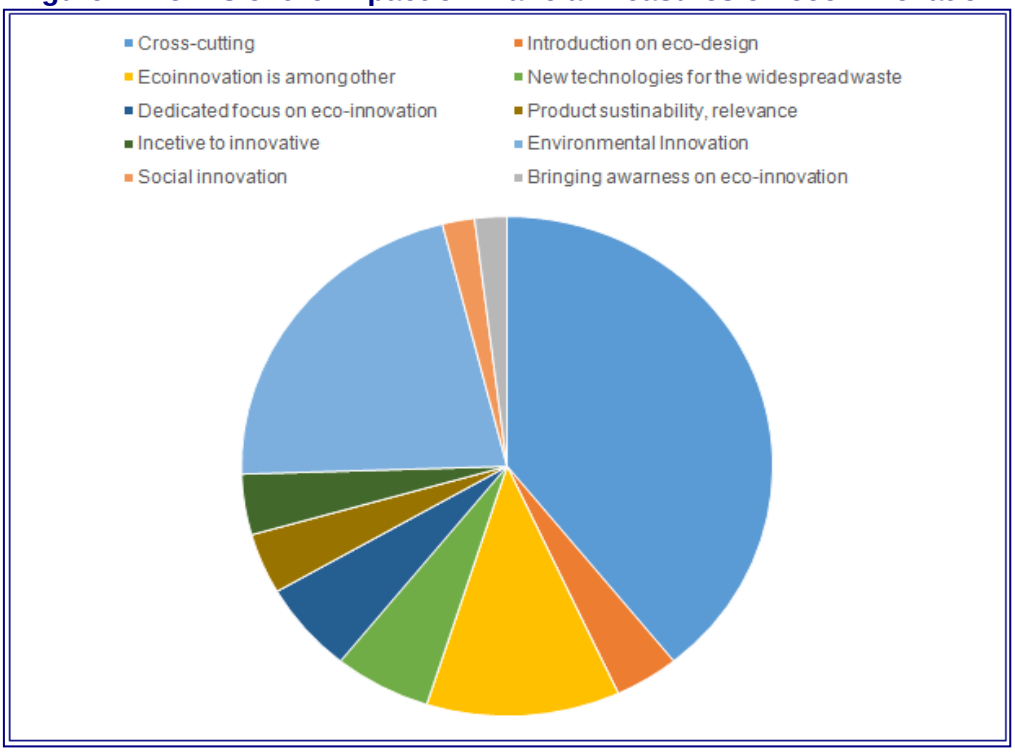
New technologies for widespread waste – Applying innovative solutions to manage large volumes of waste.
Dedicated focus on eco-innovation – Targeted financial support explicitly directed at eco-innovation.
Eco-innovation is among other topics – Projects addressed eco-innovation among other thematic areas.
Environmental innovation – Innovations aimed at reducing the negative environmental footprint.
Product sustainability and relevance – Supporting production that is sustainable and socially responsible.
Social innovation – Promoting ideas and approaches that are environmentally sustainable and socially inclusive.
Bringing awareness on eco-innovation – Public information and education campaigns highlighting the importance and benefits of eco-innovation.
Within the structure of implemented direct measures, cross-cutting measures dominate, accounting for 44%, and envirnomental innovation at 25%. In contrast, their contribution through indirect measures is lower, at 22%, indicating a greater dispersion of relevant impacts across indirect support mechanisms.
2) Financial support through the RRP is recognized as relevant to eco-innovation, the circular economy, and resilience goals. Belgium, Cyprus, Estonia, France, Greece, Hungary, Ireland, Lithuania, Malta, Poland, Portugal, Slovenia, Spain, and Sweden have acknowledged the relevance of eco-innovation, but did not explicitly reflect this relevance through direct or indirect financial support measures. Malta did not specifically highlight the relevance of the circular economy or eco-innovation in its RRP, while Slovenia linked eco-innovation relevance primarily to contributions in the area of green energy.
3) Croatia and Romania neither identified the relevance of eco-innovation in their national recovery plans nor expressed any contribution of financial support measures toward eco-innovation.

Table 3: Direct/indirectfinancial supportand relevance foreco-innovation

Country	Direct	Relevance to Eco-innovation	Indirect	Relevance to Eco-innovation
Austria	10	Cross-cutting	-	-
Bulgaria	1 1	Introduction on eco-design New technologies for the widespread waste	3	Introduction on eco-design
Czechia	4 3	Cross-cutting Ecoinnovation is among other topics	-	-
Denmark	3	Cross-cutting	2	Cross-cutting
Finland	3 2	Eco-innovation among other topics Dedicated focus on eco-innovation	1	Dedicated focus on eco-innovation
Germany	8	Environmental Innovation	2	Environmental Innovation
Italy	3	Cross-cutting	2	Cross-cutting
Latvia	1 2 1 1	Introduction on eco-design Product sustinability, relevance Social innovation Bringing awarness on eco-innovation	1 2	Product sustinability, relevance Bringing awarness on eco-innovation
Luxembourg	2	Cross-cutting Incetive to innovative	2	Cross-cutting Incetive to innovative
Netherlands	3	Environmental Innovation	3	Environmental Innovation
Slovakia	2	New technologies for the widespread waste	-	-

Source: EU, Country profiles, 2022.

Figure 1: Forms of the impact of financial measures on eco-innovation



Source: Author, based on Table 3

Specific forms of direct and indirect support include the following measures:

- Tax incentives,
- Subsidies,
- Loans and credits,
- Tax relief for consumers adopting/purchasing green technologies/products,
- Green public procurement,
- Eco-innovation challenges, prizes, and awards,
- Training for enterprises and consumers and
- Clusters, networks, and platforms.

In the case of the Netherlands, the forms of direct and indirect support are closely linked to the relevance of eco-innovation:Tax relief for consumers adopting/purchasing green technologies/products and Clusters, networks, and platforms contribute to the cross-cutting component.Tax incentives and subsidies contribute to the incentive to innovate component.The remaining four forms of support are relevant from the perspective of key objectives related to eco-innovation.

Key findings of the study indicate that there is no direct correlation between RRF funding and the value of the Eco-Innovation Index, which is to some extent consistent with the diverse priorities of RRF financial allocations, including digital transformation and other sectors. On the other hand, a stronger and more direct relationship has been identified between the Eco-Innovation Index and Eco-Innovation Inputs as a measure of financial investments in eco-innovation.Furthermore, ten EU Member States have implemented both direct and indirect financial support measures with clearly defined relevance to eco-innovation. This segmentation highlights the need to strengthen a coherent reporting system on direct and

indirect support measures at the EU level.Direct support measures tend to be more targeted and focused on a few specific areas directly related to eco-innovation, whereas indirect measures are dispersed across various domains such as eco-design,environmental innovation, product sustainability and relevance, social innovation and bringing awareness on eco-innovation.

The limitations of the study lie in the undefined time horizon between the investment and the measurement of its effects; the uncertainty as to whether investments contribute to short-term or long-term eco-innovation outcomes; the constraints related to the comparability of Index data across different years due to limited availability of harmonized data; and the lack of coherence in how support measures are presented across individual EU countries.

Conclusions

The financing of eco-innovation represents one of the key challenges for the development of EU countries and their transformative capacity toward a green transition.

Establishing mechanisms that ensure the convergence of systemic approaches to circular economy development and the availability of financial resources is essential for closing the gap between identified development potential and actual investment levels.

To monitor progress in eco-innovation and the contribution of eco-innovation to the circular economy, national economies identify key forms of relevance. Eco-innovations stimulate eco-innovativeness through cross-cutting approaches, the introduction of eco-design, new technologies for widespread waste management, a dedicated focus on eco-innovation, environmental innovation, product sustainability and relevance, social innovation, and raising awareness about eco-innovation. In addition to their impact on the environment, eco-innovations also emphasize the importance of strengthening cross-sectoral collaboration and initiatives.

National economies strive to foster the development of sustainable production—from product design, to resource efficiency, to sustainable waste management—indicating a commitment to promoting eco-innovativeness throughout the entire product life cycle. From the perspective of enterprises, eco-innovations enable numerous and diverse contributions to sustainable development.

In the coming period, it is essential that all countries establish clear links between direct and indirect support measures and their relevance to eco-innovation, and that the contribution to the growth of eco-innovativeness is expressed through measurable outcomes.

The establishment of a clear methodological framework will enable coherence and uniformity in reporting results. However, this does not diminish the financial contribution of the RRP to fostering eco-innovation.

In addition to traditional banking sources of eco-innovation financing, it will be necessary in the future to develop alternative financing mechanisms that can strengthen the eco-innovation potential of countries—grounded in innovation in product design, production, and waste management.

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ASSESSING THE SUSTAINABILITY OF INTERDISCIPLINARY ECONOMIC FRAMEWORKS

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Abstract:

The sustainability of interdisciplinary economic models has become an increasingly urgent concern amid converging global challenges such as climate change, public health crises and digital disruption. Traditional economic approaches often prove insufficient for navigating such complexity, prompting the rise of models that integrate economic, legal, environmental, technological and social dimensions. This paper investigates the sustainability of these models across three interrelated domains: financial structures, institutional design and social inclusion. Drawing on a conceptual–comparative methodology and grounded in case studies from the European Union, South Asia and Africa, the analysis reveals that models are most resilient when financial mechanisms are transparent and accountable, governance is polycentric and adaptive and inclusion is embedded as a core design principle. Importantly, the study highlights that sustainability is not only a technical or institutional challenge, but also a normative one—requiring explicit commitments to equity, distributive justice and participatory governance. However, significant challenges persist in aligning fiscal innovation with fairness, coordinating across levels of governance and operationalizing inclusive processes. These findings underscore the need for interdisciplinary approaches that institutionalize complexity rather than simplify it and call for future research on the role of digital technologies in enabling inclusive, data-driven governance.

Keywords: *interdisciplinary economic models, sustainability, governance, inclusion, resilience*

JEL classification: *Q01, H11*

Introduction

The sustainability of interdisciplinary economic models has become an increasingly urgent concern amid converging global challenges such as climate change, public health crises and digital disruption. Traditional economic frameworks often fall short in addressing this complexity, prompting the emergence of models that integrate economic, legal, environmental, technological and social dimensions. This paper explores the sustainability of

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such models across three interdependent domains: financial structures, institutional design and social inclusion. Using a conceptual–comparative methodology and drawing on case studies from the European Union, South Asia and Africa, the analysis finds that models are most resilient when financial mechanisms are transparent and accountable, governance is polycentric and adaptive and inclusion is embedded as a core design principle. Nonetheless, significant challenges remain—particularly in aligning fiscal innovation with equity, coordinating governance across multiple levels and embedding participatory processes in practice. These findings highlight the importance of interdisciplinary approaches that institutionalize complexity rather than reduce it and call for further research into the role of digital technologies in enabling inclusive, data-driven governance.

Literature Review

The sustainability of interdisciplinary economic models has garnered increasing scholarly attention in light of converging global crises—ranging from climate instability and public health emergencies to digital transformation and economic inequality. The literature addressing these models typically focuses on three interdependent dimensions: financial viability, institutional and governance adaptability and social inclusion. These themes not only structure the discussion that follows but also provide the analytical foundation for the framework employed in this study.

Financial Sustainability

A robust body of research has underscored the importance of financial innovation in supporting sustainable development objectives. Central to this discussion is the growing use of blended finance mechanisms, wherein public funds are deployed to de-risk private investment in sectors such as renewable energy, climate resilience and infrastructure (OECD, 2018a). Blended finance serves as a catalyst by mobilizing private capital toward high-impact sectors that may otherwise be perceived as too risky or unprofitable.

Complementary financial instruments such as green bonds, environmental, social and governance (ESG) investments and sustainability-linked loans have gained traction in both developed and emerging markets (Chen *et al.*, 2023). The European Investment Bank, for instance, has issued over €80 billion in green bonds, targeting sectors like renewable energy and sustainable transportation. Similarly, the World Bank's issuance of sustainability-linked bonds illustrates the potential for leveraging capital markets to finance climate-aligned and socially responsive growth (Huang, 2024; Schneider, 2024).

However, the literature also warns of emerging risks associated with these instruments, particularly in the absence of standardized metrics and robust regulatory oversight. Without proper accountability mechanisms, such tools can contribute to "greenwashing," where the label of sustainability is applied without delivering verifiable social or environmental outcomes (OECD, 2018a; Chen *et al.*, 2023).

Institutional and Governance Sustainability

The second pillar of sustainability emphasizes the institutional and governance frameworks that support interdisciplinary models. Elinor Ostrom's theory of polycentric governance offers a foundational perspective, highlighting the benefits of distributed, overlapping decision-making systems that operate at multiple scales and foster localized problem-solving (Ostrom, 2010).

In the European Union, the integration of mission-oriented innovation policies has provided a tangible application of such principles. Horizon Europe, for example, incorporates multi-actor platforms and cross-sectoral missions that address complex challenges like climate neutrality, health and digital inclusion. Mariana Mazzucato's work has been particularly influential in advocating for such public-purpose-driven innovation strategies(European Commission, 2018).

Despite these advances, significant gaps remain in institutional capacity, especially in contexts marked by weak administrative infrastructure or fragmented governance. The COVID-19 pandemic, as noted in comparative OECD assessments, revealed critical vulnerabilities in centralized systems that lacked robust mechanisms for local engagement and adaptive feedback.

Equity and Inclusion Sustainability

A growing segment of the literature stresses that economic models cannot be considered sustainable without explicitly addressing equity and inclusion. Development scholars such as Amartya Sen and Thomas Piketty argue that distributive justice and participatory governance are not only ethical imperatives but also functional prerequisites for long-term system stability(Sen, 2000; Piketty and Goldhammer, 2020).

Inclusive finance mechanisms—such as microcredit, cooperative banks and social business models—are frequently cited as effective tools for expanding economic access. The Grameen Bank's microfinance framework, which has empowered millions of low-income women in Bangladesh, is often regarded as a benchmark for socially inclusive financial systems (Weber and Yunus, 2007).

At a regional level, the European Union's Just Transition Mechanism has demonstrated how economic transformation strategies can be explicitly designed to mitigate social and territorial inequalities. By allocating targeted support to regions dependent on carbon-intensive industries, the mechanism seeks to ensure that no one is left behind in the green transition (European Commission, 2020).

Nonetheless, the literature also points to persistent inclusion gaps. Digital exclusion, gender disparities and uneven regional development continue to hinder access to resources, representation and resilience. Many interdisciplinary frameworks still lack robust inclusion metrics and accountability processes, limiting their transformative potential.

In sum, the scholarly consensus suggests that interdisciplinary economic models must balance technical innovation with institutional legitimacy and social justice. The following sections operationalize these insights through a structured methodology and comparative case analysis.

Methodology and Data

This study adopts a conceptual–comparative methodological approach, designed to capture the complexity and interdisciplinarity inherent in sustainable economic models. Rather than relying on single-variable causality or purely empirical generalizations, the method integrates theoretical insight, institutional design and context-sensitive evidence to assess the financial, institutional and social sustainability of economic frameworks (George and Bennett, 2005).

Data Sources

A broad spectrum of qualitative and documentary data informs this analysis, drawing on:

•Regulatory frameworks: including major European Union policy instruments such as the European Green Deal, the NextGenerationEU recovery plan and the Horizon Europe research agenda;

•Institutional and development reports: from international organizations including the OECD's blended finance principles, UNDP Human Development Reports and World Bank climate finance updates;

•Academic scholarship: comprising peer-reviewed articles, monographs and policy studies across economics, development theory, sustainability science and public administration.

The triangulation of these sources ensures both conceptual rigor and contextual relevance, allowing the study to bridge abstract principles with grounded policy practices.

Analytical Framework

To assess the sustainability of interdisciplinary economic models, this study employs a three-pillar evaluative framework encompassing financial structures, institutional design and social inclusion. Each dimension is conceptually distinct yet empirically interdependent, forming a comprehensive basis for evaluating how economic systems integrate sustainability principles across governance levels and contexts.

The first dimension, financial structures, addresses the composition and architecture of funding mechanisms that underpin sustainable transformation. It considers instruments such as green bonds, blended finance vehicles and public–private partnerships, emphasizing their risk-sharing arrangements, capital mobilization capacity and long-term fiscal viability. Financial sustainability in this sense extends beyond mere solvency to encompass the resilience and accountability of financing flows, ensuring that economic transformation efforts are both scalable and durable.

The second dimension, institutional design, examines governance architectures that shape policy coordination and implementation. Particular attention is paid to the degree of decentralization, the mechanisms that facilitate stakeholder collaboration and the administrative learning capacities that enable adaptive policymaking. Within this context, polycentric governance and mission-oriented institutions serve as critical indicators of institutional sustainability, reflecting the system's ability to respond flexibly to emerging challenges while maintaining strategic coherence.

Finally, the social inclusion dimension explores the extent to which economic frameworks embed participatory processes and distribute outcomes equitably. It evaluates whether models succeed in extending access to marginalized communities, promoting civic engagement and ensuring fairness across regions and demographic groups. Inclusion, in this framework, is treated not as an ancillary goal but as a constitutive element of sustainability, central to both legitimacy and long-term effectiveness.

These analytical dimensions are applied to a set of comparative case studies selected for their institutional diversity and sectoral relevance. Germany's Energiewende illustrates the coordination between federal and local governance structures in achieving decarbonization. The European Union's Just Transition Fund exemplifies how financial mechanisms can promote territorial equity within climate policy. The Grameen Bank model in Bangladesh demonstrates the transformative potential of grassroots-based financial inclusion, while the African Union's Agenda 2063 provides a continental vision of long-term strategic economic planning. Together, these cases offer a multidimensional perspective on how interdisciplinary economic frameworks operate across varying political, financial and social environments.

Rationale

The conceptual–comparative method presents distinct advantages for analyzing interdisciplinary economic systems. It enables the integration of normative frameworks with empirical observations, accommodates context-specific variation and facilitates the identification of causal patterns in complex, multi-level governance settings. In contrast to strictly empirical or quantitative approaches, this method embraces reflexivity and layered causality—essential features when examining how interdisciplinary models emerge, adapt and perform over time(George and Bennett, 2005).

By employing this approach, the study is well-positioned to reveal both the structural conditions and contextual dynamics that shape the sustainability of economic interventions across diverse institutional landscapes and policy domains.

Results

This section synthesizes the empirical and conceptual findings based on the three-dimensional framework outlined earlier—financial structures, institutional adaptability and social inclusion. Drawing from comparative case studies, it elucidates the conditions under which interdisciplinary economic models demonstrate resilience, legitimacy and transformative capacity.

Alignment with Territorial and Social Needs

Interdisciplinary economic frameworks exhibit heightened sustainability when their design is responsive to territorial specificities and local developmental priorities. The European Union's Just Transition Mechanism exemplifies this approach by allocating funds based on nuanced assessments of socio-economic vulnerability and environmental impact (European Commission, 2020). Targeted investments in workforce retraining, infrastructure modernization and social safety nets have demonstrated that economic tools—when aligned with the lived realities of communities—can support both decarbonization and social cohesion. Conversely, uniformly applied instruments such as flat-rate carbon taxes, in the absence of compensatory measures, have often exacerbated inequalities, leading to public resistance and policy failure(Andersson and Atkinson, 2020).

Knowledge Co-Production

A salient feature of robust interdisciplinary models is the institutionalization of knowledge co-production. Rather than relying on top-down policy prescriptions, sustainable frameworks integrate insights from academia, civil society, local communities and private sector actors. Horizon Europe, particularly through its mission-oriented innovation strategy, exemplifies this paradigm by embedding participatory foresight and interdisciplinary collaboration throughout the policy lifecycle (European Commission, 2018; Kattel and Mazzucato, 2023). The resulting policies are not only more legitimate but also better calibrated to real-world complexity.

Polycentric and Adaptive Governance

Polycentric governance structures significantly enhance the adaptive capacity of economic models, allowing for flexibility in the face of uncertainty. Germany’s Energiewende policy offers a compelling illustration of this principle. The collaborative interaction between municipal utilities, state governments and federal ministries has fostered an ecosystem in which policy experimentation and learning are institutionalized (Morris and Jungjohann, 2016). In contrast, centralized models often lack the responsiveness necessary for

navigating systemic shocks, as evidenced during the COVID-19 pandemic in several unitary states(OECD, 2018b).

Financial Innovation and Monitoring

While financial innovation—manifested in instruments such as green bonds, ESG funds and sustainability-linked loans—has successfully mobilized capital, its contribution to sustainability hinges on the presence of robust accountability mechanisms. In the absence of standardization and independent verification, such instruments risk becoming vehicles for symbolic compliance or "greenwashing" (Pistor, 2019; OECD, 2021). Effective interdisciplinary models thus incorporate rigorous monitoring frameworks, aligned with international standards such as those from the International Capital Market Association (ICMA), to safeguard financial credibility and policy alignment.

Inclusion and Equity Gaps

Despite normative commitments to inclusion, many interdisciplinary initiatives underperform on this dimension. Structural barriers—including digital exclusion, gender disparities and rural-urban divides—continue to impede broad-based participation. While community-driven models like Grameen Bank offer scalable insights into inclusive finance (Weber and Yunus, 2007), replicability remains contingent on local context and institutional support. Moreover, intersectional approaches to equity—accounting for overlapping vulnerabilities—are still underdeveloped in most policy designs. The challenge, therefore, lies not merely in rhetorical commitments to inclusion but in embedding distributive justice as a cross-cutting design principle (Sen, 2000; Piketty and Goldhammer, 2020).

This research founf that the sustainability of interdisciplinary economic models hinges on three interdependent dimensions: financial resilience, institutional adaptability and social equity. Each dimension reinforces the others: without financial innovation, models lack scalability; without governance flexibility, they are fragile; and without inclusion, they lose legitimacy.

Policy recommendations include the following:
•Promote transparent and accountable financial instruments aligned with the SDGs.
•Strengthen polycentric governance through decentralization and participatory planning.
•Institutionalize knowledge co-production through mission-oriented public programs.
•Embed social equity as a foundational principle across all stages of economic policymaking.
Future research should explore the role of digital technologies, such as AI and blockchain, in improving data governance, transparency and stakeholder engagement. Moreover, comparative empirical studies could help evaluate which combinations of financial, institutional and social mechanisms are most effective across contexts.
Interdisciplinary economic models offer a pathway toward more inclusive, resilient and future-ready economies. Their success, however, depends on continual evaluation, stakeholder alignment and institutional courage to embrace complexity.

Conclusions

This study has underscored the multifaceted nature of sustainability in interdisciplinary economic models, emphasizing the interplay between financial resilience, institutional adaptability and social inclusion. These three dimensions operate not as isolated pillars but as mutually reinforcing elements that determine the viability and legitimacy of economic transformation efforts.

Financial innovation, particularly through green bonds, blended finance and sustainability-linked instruments, enables resource mobilization but must be accompanied by strong governance and accountability frameworks to avoid performative sustainability. Likewise, institutional adaptability—anchored in polycentric governance and mission-oriented policies—enhances systemic resilience and responsiveness to uncertainty. Crucially, the normative foundation of interdisciplinary models must rest on distributive justice. Without explicit commitments to equity and inclusion, even the most technically sound models risk reproducing or deepening existing disparities.

Policy recommendations emerging from this analysis include the institutionalization of transparent and accountable financial instruments aligned with global sustainability targets; the reinforcement of decentralized and participatory governance structures; the integration of knowledge co-production within policy design and implementation; and the prioritization of equity as a structural—not symbolic—principle across economic programming.

Further research is warranted to explore the potential of digital technologies—such as artificial intelligence, blockchain and participatory platforms—to strengthen transparency, inclusion and monitoring capacity in economic governance. Comparative empirical studies, particularly those grounded in regional and sectoral contexts, can provide deeper insights into which model configurations most effectively foster long-term sustainability.

Ultimately, interdisciplinary economic models represent more than technical exercises; they are normative frameworks capable of reshaping economic

governance in ways that are inclusive, adaptive and forward-looking. Their success depends not only on innovation and coordination, but also on the courage of institutions to embrace complexity as a defining feature of sustainable development.

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